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FEATURE SECTION

Editor's Note. The following ten articles were invited by the Editor to sample opinions and assay the status of graduate instruction as it exists in the various areas of pharmaceutical education.

GRADUATE EDUCATION IN PHARMACEUTICAL TECHNOLOGY

LOUIS W. BUSSE

When one writes on education for a certain area in pharmacy one is always concerned about "semantics" and whether one's readers have the same understanding of the term as the writer. Because of the differences in interpretation of the terms used to designate the various areas of pharmacy, I believe it best to state our concepts of these specialty areas of pharmacy in order that further misunderstandings are not forthcoming.

It appears that in recent years, graduate programs in schools of pharmacy have been developing irrationally and without much thought to the autonomy of an area as a specialty in pharmacy. Similar developments occurred several years before this in the professional curriculum, and at that time many people wondered whether pharmacy had become so specialized as to warrant programs in hospital pharmacy, dental pharmacy, veterinary pharmacy, industrial or manufacturing pharmacy, etc. After these many years it appears that two of these, hospital pharmacy and industrial pharmacy, have become established as areas of specialization with some degree of success.

Recently we have had such areas of specialization as pharmaceutical technology and physical pharmacy developed at the professional level. There is still much discussion going on over the relative contents of these two areas and even of the merit of these courses as such.

It seems to me, however, that we can expect and even agree that we should have these areas of specialization in the professional curriculum, for in the professional curriculum we are very much concerned with the student learning the "how" of doing things and with having him achieve a certain level of skill in various techniques. Certainly, we are interested in having the student know "why" he is doing a certain procedure the way he is or "why" a certain reaction takes place; nevertheless, our primary responsibility as a professional school is to be sure the student knows "how." In reality, we are responsible for developing a certain level of competence in each pharmacy graduate. This fact may be the basis for the many specialty areas and the many courses in our professional curriculum. We feel we must teach students "how" to do things in a hospital pharmacy; "how" to do things in a manufacturing laboratory; "how" to do things in a dispensary, etc. The so-called physical pharmacy and pharmaceutical technology areas were developed specifically to add more of the "why" or to help the student achieve a better understanding of the procedures he will encounter in the practice of his profession.

As one observes the development of graduate work in schools of pharmacy over the past years, it seems that many have assumed that because these areas of specialization exist in the professional curriculum, they must also exist in the graduate area. Thus we have graduate programs being offered in industrial pharmacy, hospital pharmacy, manufacturing pharmacy, physical pharmacy, pharmaceutical technology, etc. This degree of specialization at the graduate level is not only unwarranted, but even more it is undesirable.

Specialization in pharmacy at the professional level is based on where and how the profession is practiced, e.g., hospital, industry, drugstore. This is practical and may be considered desirable. At the graduate level, however, specialization on anything other than an academic basis should not be condoned.

It is our opinion then, that at the present time the divisions of a school of pharmacy, i.e., pharmacy, pharmaceutical economics, history of pharmacy, pharmaceutical chemistry, pharmacognosy, and pharmacology, should be the special programs of graduate study, and that degree programs should be limited to these areas. We have added history of pharmacy as an area of specialization at the graduate level. This seems justified in that the research material and the research procedure on problems in this area are sufficiently different from pharmaceutical problems in the science field that departmental status should be given this area. However, in this paper we shall limit our discussion to pharmacy.

Pharmacy at the graduate level should not be considered a profession, but should be thought of as a science. Since pharmacy is the term we use to describe the profession, however, this statement may sound a bit incongruous. Nevertheless, many schools of pharmacy are not permitted to offer the doctor of philosophy degree for work in pharmacy primarily for this reason. This difficulty in understanding the use of the word pharmacy to describe the profession on the one hand and to describe the science on the other has made it difficult for other groups to consider graduate work in pharmacy as a field of research. This has caused some of us to give serious consideration to proposals that the Ph.D. degree be given in pharmaceutical science rather than in pharmacy. This concept has many ramifications. However, it seems to make some sense, and I believe that we should give some serious study to this suggestion and explore the effect this might have on bringing some order into our present chaotic terminology.

Up to here, what we are saying is that in the graduate area of pharmacy there is really only one area of specialization and that area is termed pharmacy. The professional specialization such as hospital pharmacy should be primarily limited to the undergraduate curriculum. Certainly, no work beyond a master's degree is conceivable at this time. Similarly such a specialty as manufacturing pharmacy should primarily reside in the professional curriculum. Here, too, work at the graduate level is seriously open to question and should be limited to the master's level if given at all. It is extremely difficult to visualize a research problem in this highly applied area which would meet the requirements for the doctor of philosophy degree.

The two remaining areas in question, i.e., pharmaceutical technology and physical pharmacy, at the graduate level do not seem to exist as separate areas of study. The difference, if any, is very slight and very subtle.

The term physical pharmacy was originally proposed to describe a course in which the major emphasis was on the study of those physical and chemical principles or laws which are applicable to the study of pharmaceutical systems.

Since the introduction of this term in 1951, there have been many papers presented on physical pharmacy in an effort to clarify the subject matter to be given under this title.

As I studied these, I gathered the impression that many teachers of pharmacy have not been able to distinguish physical pharmacy from pharmaceutical technology and that what they are now teaching in the course called physical pharmacy is properly pharmaceutical technology. This is understandable when one considers the newness of the terms and the fact that the difference is really quite subtle.

The sequence of courses in the professional curriculum in this area of pharmacy would logically be physical chemistry, physical pharmacy, and pharmaceutical technology. The physical chemistry course should be a standard survey physical chemistry course in which those principles or laws which are applicable to the study of pharmaceutical systems would be covered; however, it should not be limited to these. The physical pharmacy course would then follow with a thorough and quantitative study of those laws of physics and physical chemistry which we use to study pharmaceutical systems in an effort to better understand them, and to acquire the ability to use them quantitatively. This would include such subject matter as the structure of matter, solution and solution equilibria, the colloidal state, heterogenous systems, the physical rate processes, including viscosity, sedimentation, diffusion, and the chemical rate processes such as hydrolysis, oxidation, and other degradation reactions. It should be emphasized here that in this treatment we are studying this subject matter in its theoretical aspects and not necessarily in its practical applications. We have to know very much more about the above subject matter than it is possible to achieve in the basic physical chemistry course.

Pharmaceutical technology now resolves itself into a study of the pharmaceutical system itself. Thus we see that in our sequence we were introduced to physical laws and principles in our physical chemistry; we became familiar with their use in the interpretation of data in our physical pharmacy; and lastly we applied these laws to an understanding of the system itself in the technology course.

We might use the following illustration to help us appreciate this difference. In the broad sense of the term, in pharmaceutical technology the student would study and learn the application of the principles to drug stability studies and be responsible for programming studies which would predict stability periods based on data acquired from exposure of the drug to exaggerated conditions. As another example, we might develop a course under the title, "Preservation and Stabilization of Pharmaceuticals." This refers, of course, to a study of the methods of *preserving* pharmaceuticals against bacterial and mold growth and to the *stabilizing* of pharmaceuticals against chemical decomposition. While we have a specific course title, actually the subject matter is a portion of the area of study which we call *pharmaceutical technology*.

Research-wise or problem-wise we might use the following illustrations. Research studies under such titles as, "The Kinetics of the Degradation of Chloramphenicol"; "The Complexing Behavior of Sarcosine Anhydride"; or "The Thermodynamic Activity of Sarin in Solution," we might designate as studies in the physical pharmacy category. Research studies such as, "The Stabilization of Amyl Nitrite Pearls"; "The Effect of Type and Concentration of Binders on the Hardness and Compressibility of Sulfathiazole Tablets Made at

Constant Pressure"; "Spraydrying of Insoluble Weakly Acidic Pharmaceuticals Through Their Ammonium Salts"; or "The Influence of Electrolytes, pH, and Alcohol Concentration on the Solubilities of Acidic Drugs," we might designate as studies in the category of pharmaceutical technology.

I would be the first to admit that the difference in these two areas may be considered arbitrary at the graduate level, and, in fact, to attempt to break pharmacy down into its various progenies at the research level is almost futile. In fact, I am of the opinion that at the graduate level the term pharmacy is both broad enough, and, in another sense, specific enough to cover all its ramifications. Specialization should be limited primarily to the undergraduate curriculum. If specialization can be justified at an advanced level, it should be on a professional basis and should be taken care of by professional degrees, not through research degrees.

If this is true, then certainly the academic preparation for a Ph.D. degree in pharmaceutical technology or physical pharmacy should be considered synonymous with a Ph.D. degree in pharmacy. This also indicates that course preparation for work in these fields will of necessity be very similar. It is for this reason then that I would recommend the following program of course work for anyone seeking a career in pharmacy at the graduate level. I would consider this as a basic program and consider each course as essential to one's training.

1. Chemistry
   a. Advanced Organic Chemistry
   b. Characterization of Organic Compounds
   c. Physical Chemistry
   d. Chemical Kinetics
   e. Advanced Pharmaceutical Chemistry
2. Mathematics
   a. Calculus
   b. Differential Equations
3. Pharmacy
   a. Instrumental Procedures
   b. Preservation and Stabilization Techniques
   c. Heterogenous Pharmaceutical Systems
   d. Homogenous Pharmaceutical Systems
   e. Extraction and Isolation Techniques
   f. Research Seminars
   g. Pharmaceutical Manufacturing
4. Research

This program is designed for students who have graduated from the usual professional curriculum which as we all know is deficient in advanced basic science training. We, of course, are assuming the opportunity to complete many of the basic science courses prior to graduation would not be available to many students.

I would recommend this as a basic or minimum program for all students planning to major in pharmacy (pharmaceutical technology or physical pharmacy). Courses beyond this selection should be left to the interest of the student, to the requirements of his minor, and the advice and counsel of his major professor.

It is quite obvious that this is a heavy program of academic work—nevertheless, it is necessary for students coming into graduate school with these basic science deficiencies. To any pharmacy student reading this, I would recommend that it would be very much to his benefit to make use of any undergraduate electives to remove as many of these deficiencies as possible. Specifically I would recommend calculus and physical chemistry as being the most helpful.

This program of course work plus a sufficient amount of training in research procedures will prepare a young person excellently for an academic career in teaching and research or for a career in industry. The opportunities for young people with this type of training are numerous both in the academic field and in the field of industry. Many additional opportunities in the teaching field will be forthcoming when the five year program goes into effect. This is true for many additions to the staffs of schools of pharmacy will be needed in the pharmacy area since this is an area which is scheduled for expansion in most schools of pharmacy.

In conclusion, I should like to call to the attention of all of the faculty people their responsibility in recruiting young people for graduate study. Just as it is the responsibility of our professional people to perpetuate the profession, so it is our responsibility to perpetuate our own group as teachers. This will become even more essential in the future under the impact of our lengthened educational program. Remember, recruitment at the graduate level is your responsibility and mine.

Education is the cornerstone of democracy. Therefore, leave no stone unmoved to rebuild and remake your faculty for the great days before us. We shall not care about such minor things as buildings and programs. The independent scholar and teacher and the inquiring mind of the student, these are the inner circle of a great college. It was always so and it must always be so. To do otherwise is to fall for regimentation alien to the American.

A. W. Bromage, Am. J. Pharm. Ed., 9, 552 (1945)

GRADUATE TRAINING FOR INDUSTRIAL PHARMACY

ALBERT M. MATTOCKS

Before deciding upon the training required to prepare a student for industrial research or production, it is first necessary to examine our starting material, the new graduate who has just completed his study for the bachelor's degree. What are his strengths and weaknesses in personality, basic scientific knowledge, and specialized application? Viewing these in the light of the needs and demands of industry we may arrive at a satisfactory program of training.

PERSONAL QUALIFICATIONS

Our student first entered college to prepare himself for work in a retail pharmacy. He made better-than-average grades, and toward the end of his curriculum, possibly a year to eighteen months before graduation, he became aware of the opportunities offered by graduate study. He became interested in industrial pharmacy for several reasons: (1) Industry offers greater use of his creative talents and specialized training. (2) He is interested in advancing his knowledge and ability. (3) Industry offers greater security and shorter hours, especially when one has no nest egg for investment. (4) He has come to dislike retail pharmacy, especially its storekeeping, business management, and selling aspects.

One might add to or subtract from the reasons listed above, but the critical point is that our student entered college planning to be a retail pharmacist, then changed his mind at some time during his college career. Had he been the gregarious, extrovert type it seems that he would have retained an interest in dealing with the public, selling, and procuring a pharmacy of his own in the future. Thus, we might expect the majority of our students to be not the hearty-handshake type but rather the studious, quiet, introverted type.

Industry, on the other hand, demands persons with ability to mix well with others at various levels of position within the plant. They admit to placing a value of 36 per cent on the personality of the candidate being interviewed (1), and those of us who have observed their methods for selection of personnel for several years might think this quite a low estimate. Dr. Blythe (1) even suggested that we might accept only extroverts in our graduation programs. Although we might agree with him in principle, we would find ourselves with drastically cut enrollments if we followed this practice.

This leaves us with a question: Can we do anything in our training program to improve our students' personal qualifications for industry? Can we include in our program experience in dealing with many individuals, teaching the student to take an interest in the personalities of other people, expanding his social activities, and teaching him cooperativeness. Certainly the undergraduate schools have emphasized personal development extensively, and the college campus seems to be the ideal place for such development, but this is usually neglected on the graduate level.

Seeing the importance attached to personality by industry, it becomes our duty to expend some effort in this direction. We should have more research

conferences with small groups of students. We should urge cooperation at every opportunity, letting the experienced student teach the newcomer the use of certain equipment, or the technique for handling data, even helping him to find a suitable room or apartment, or showing him how to go through registration. We might make our laboratory assignments more flexible, changing "labmates" every year or two. Perhaps the best means of developing confidence and understanding in an individual is to have him teach. Unfortunately, it is often not possible to keep a graduate student in a teaching position for more than a year, since there are more students than teaching positions. Yet, would it not be worthwhile to have those on fellowships do a limited amount of teaching on a higher level? Perhaps three or four lectures a year, followed by class discussion, would be quite useful. The graduate seminar also helps the student to develop confidence and poise, especially if a lively discussion period follows the presentation.

Attendance at student scientific associations such as the ACS and PLU should be encouraged, as well as participation in some social and sports activities.

It has been interesting to note that the students, themselves, are quite appreciative of any suggestions made to them for their self-improvement. Constructive criticism given directly to the individual is perhaps the most effective way of correcting specific personality problems.

This lack of attention to personal development of the student is perhaps our greatest weakness in meeting the needs of industry. It is a difficult task and is deserving of further attention.

SCIENTIFIC QUALIFICATIONS

It has been disturbing to note that our beginning students generally are rather poorly prepared for advanced science. It does not seem possible, however, for a general pharmacy curriculum aimed at retail pharmacy practice to include a scientific background adequate for one entering advanced training. Our student usually has had a satisfactory course in inorganic chemistry, insufficient training in organic chemistry and in analytical chemistry. His knowledge of physics is frequently inadequate, and his mathematics seldom goes beyond trigonometry. Generally, his elementary work in the biological sciences is good. Our student, today, has a fairly broad knowledge of science but no rigorous training in individual scientific areas. It would seem that the undergraduate courses have the objective of acquainting the student with the subject rather than having him acquire a working knowledge and thorough understanding which might serve as a background for further work.

The student's knowledge of pharmacy should not be exempted from examination. We note that pharmacy also has been learned without a thorough understanding of the basic principles involved. A limited amount of mathematical treatment has been presented due to insufficient mathematics background, and application of physical laws has been treated lightly due to lack of a thorough knowledge of physics and physical chemistry.

Looking at the requirements of industry, we see that our Ph.D. graduate should be firmly grounded in organic and physical chemistry, should have a useful knowledge of statistical analysis, training in industrial pharmaceutical processes, an understanding of microbiology, pharmacology, and perhaps a limited knowledge of mechanical engineering and industrial management. Also, he

must have the ability to plan and execute research projects and to make correct decisions as to the most effective approaches to solutions of research and production problems.

To achieve the goals set for us by the demands of industry we have not only to offer advanced training, but also to offer basic training in areas of science neglected in the undergraduate curriculum. As we gain experience we become more aware of the importance of course sequence to the student. One can skip analytical geometry and still pass calculus, but he will find himself handicapped in physical chemistry and in interpretation of research data. He can get through physical chemistry without a strong background in physics, but he will not have the understanding required for graduate pharmacy courses or his research. A student can take calculus concurrently with physical chemistry, but will meet with difficulty when he reaches kinetics or advanced physical pharmacy. Thus, to have the student prepared for the advanced sciences we must make certain that his background in mathematics and physics is complete.

Advanced studies also should have definite sequence in many instances. Physical chemistry should come early in the curriculum, serving as a prerequisite to instrumental analysis, kinetics, colloids, thermodynamics, etc., but also aiding considerably in the understanding of advanced microbiology, pharmacology, and biochemistry.

The advanced pharmacy courses should be given as near the end of the graduate student's course work as possible. It is one of our problems that the student must re-learn pharmacy in the light of the more thorough scientific knowledge he has acquired. Finally, he must learn to apply scientific principles to the solution of problems in pharmacy. Pharmaceutical research, which may be defined as the application of basic science to the solution of pharmaceutical problems, is the major goal of our student, and this should be the focal point of our training program. We should illustrate in our courses the application of all areas of advanced study to pharmacy, including physics, physical and organic chemistry, mathematical analysis and interpretation, derivation of new laws, etc., as well as pointing out the weaknesses of our knowledge of pharmaceutical systems and the needs for future studies.

A GRADUATE CURRICULUM

Assuming our beginning student to have a sound knowledge of elementary physics and organic chemistry, adequate undergraduate training in biochemistry, pharmacology, and microbiology, with mathematics through analytic geometry, we might set up the following curriculum of course work leading to candidacy for the Ph.D. degree:

A Graduate Curriculum for Industrial Pharmacy

1st Year	*Hours*		
	Fall	*Spring*	*Summer*
Calculus & Different. Equ.	5*	4*	2
Manufacturing Pharmacy	3	3	—
Advanced Organic Chem.	—	3	—
Qualitative Organic	—	—	2
	8	10	4

(Note: Allowance made 1st year for teaching assistantship)

2nd Year			
Physical Chemistry	5	5	—
Statistical Analysis	3	3	—
Microbiology (Adv.)	3	—	—
Pharmacology (Adv.)	—	3	—
Instrumental Analysis	—	—	3
Heterocyclics (Org. Chem.)	—	—	3
Seminar	1*	1*	—
	12	12	6
3rd Year			
Kinetics	3	—	—
Colloid Chem.	3	—	—
Advanced Biochem.	3	—	—
Advanced Physical Chem. (Phase Rule or Thermodynamics)	—	3	—
Radiochemistry	—	3	—
Physical Pharmacy I	—	3	—
Pharmacy-Experimental Designs	—	—	3
Research	1	1	2
Seminar	1*	1*	—
	11	11	5
4th Year			
Physical Pharmacy II	3	—	
Product Development	—	3	
Research	6	6	
Seminar	1*	1*	
	10	10	

* No graduate credit.

Recommended electives to be substituted for required courses with permission of adviser

Special topics in biochemistry—2 hr. ea.
Special topics in pharmacology—2 hr. ea.
Linear algebra—4 hr.
Computer programming—3 hr.
Fermentation—3 hr.
Unit operations—3 hr.
Technical report writing—2 hr.

This is a full schedule of study, and yet one hesitates to delete any of the courses, each one seeming essential. In fact, it would be highly desirable to add all of the list of recommended electives, but this would extend the program at least a year for most students. When the incoming student does not have analytical geometry or a satisfactory course in physics it is frequently necessary to add these courses to the first year and delete a course or two, such as an advanced physical chemistry course or radiochemistry, from the individual's curriculum.

There is need for still another course in the physical pharmacy series. The first course deals with solutions, presenting information beyond that of the physical chemistry courses on solubility, pH, reaction kinetics, and solubilization, with emphasis on pharmaceutical materials and systems. The second course presents emulsions, suspensions, and surface phenomena. The course titled product development includes powder technology, physical stability, characteristics of dosage forms, and rheology. This course needs to be divided to allow adequate coverage of the subjects, and it is suggested that rheology be made a separate two-hour course. This change has not been made yet, since the present curriculum simply does not allow expansion without extension of time.

At this point it might be noted that within a five year undergraduate curriculum it should be possible to offer the student interested in graduate study the complete first year of the graduate curriculum outlined above. This would make it possible for a student to go from high school to a Ph.D. degree in the same time (eight years) as now required, in spite of the addition of a year to the bachelor's program. It is hoped that in view of the need for research and teaching personnel the colleges of pharmacy will modify their five year curricula for prospective graduate students and thus not add to the over-all time required to obtain the Ph.D. degree.

A graduate curriculum as outlined above is a radical departure from the older-type program requiring three or four years' laboratory research. It offers less opportunity for publication to the graduate teacher. It definitely calls for understanding by the sponsors of fellowships, since little research can be reported in the first two years of the student's program. Nevertheless, the strengthening of the scientific background of the student by extensive course work appears to be the soundest method for improving the quality of pharmaceutical research personnel. With the rapid increase in the body of knowledge occurring today it appears that we may have to go still further with this trend and perhaps be satisfied some day to have trained men for research without having had them actually perform research in the university. An alternative would be to make our programs more highly specialized and limit the scope of course work given the student.

SUMMARY

It is noted that industry has placed much importance on personality of the Ph.D. graduate, though little is being done directly by the graduate schools to improve personal qualifications of the students. The demand for strong training in the basic sciences is being met by the graduate curriculum, but it remains to be seen whether industry will support graduate training *per se* or will continue to award fellowships on the basis of research results.

REFERENCE

(1) Blythe, R. H., *Am. J. Pharm. Ed.*, 21, 354 (1957).

The best augury of a man's success in his profession is that he is willing to make it the finest in the world.

Simon E. Sobeloff, Am. J. Pharm. Ed., 8, 310 (1944)

GRADUATE TRAINING IN PHARMACOLOGY

E. G. GROSS AND J. P. LONG

Pharmacology is often defined as "the action of a chemical compound on living protoplasm." This obviously means that pharmacology is a broad science and would include knowledge of a chemical compound in relation to its physiological actions, source, chemical properties, absorption, metabolic pathways, excretion, and therapeutic uses, if any.

While pharmacology is a discipline that emerged from other biological sciences, its scope and areas of interest are now unique to this field. The areas of pharmacology may be outlined briefly as follows: (1) Dose response and time-concentration relations, (2) localization and site of action, (3) absorption, distribution, metabolism, and excretion of chemicals, (4) pharmacodynamics or mechanism of action of drugs, (5) relationship between chemical structure and biological activity, frequently designated as SAR studies. Naturally, from an operational point of view, many pharmacologists combine more than one area of the total subject. This is good for the long-range advancement of pharmacology.

From a student's point of view, the areas outlined above make it compulsory that he has a diversified background. Even if he eventually does research in only one area, it is imperative that the pharmacologist keep abreast with related sciences. Thus, as a minimum, he must be well trained in physiology, all branches of chemistry, biology, comparative anatomy, and mathematics.

In view of the wide scope of training required, let us consider the formal courses that should be considered in order to enter pharmacology as a career. The following is an outline of course work for undergraduate and graduate work.

UNDERGRADUATE TRAINING

Since no school offers an undergraduate degree in pharmacology, the most that a student can hope to do is to prepare himself properly for graduate study. Undergraduate course work will be his last opportunity to take extensive courses in the following: Humanities, English composition and public speaking, foreign languages (French and German preferred), philosophy, etc. In addition to the liberal arts courses mentioned, an ideal science background would consist of the following: general zoology, comparative anatomy, physics, mathematics through integral calculus, and chemistry (inorganic, quantitative analysis, organic chemistry, and qualitative organic chemistry).

While a research man cannot be an expert in all fields, it is essential that the modern scientist make a positive effort to be intelligently informed in the political, social, and economic world. Too often the scientist withdraws within his so-called "ivory tower" and disregards all interests other than his own scientific area. Indeed, often this scientific area of endeavor is narrow and at best understood only by a few. Today the scientist must both excel in his own discipline and have an operational knowledge of society as a whole.

Seldom do we encounter students seeking a career in pharmacology with such an ideal background as outlined above. A common reason for lack of adequate preparation is that students at the high school level and even beginning

college years are not acquainted with the various basic medical sciences. They have been informed of major health sciences such as medicine, dentistry, and pharmacy, but as a rule have no knowledge of the scientific components of these professions. Therefore, the major problem in accomplishing proper preparation for graduate training in the field of pharmacology is to acquaint the prospective college students with the scope and requirements of this field. Only within the last couple of years has there been a concerted effort to bring such information to the high schools of the nation. A pamphlet prepared by the Educational Committee of the American Pharmacology Society and entitled *Career in Pharmacology* has been mailed to all high schools and colleges in the United States. If this pamphlet is not available in any particular school, it may be obtained by writing to the Secretary of the Pharmacology Society, Beaumont House, 9650 Wisconsin Avenue, Washington 14, D.C. For a "quick look" at pharmacology this is probably the best-prepared description that has even been printed. We feel confident that this pamphlet will bear fruit in acquainting future students with the field of pharmacology. Once the high school student's interest is aroused, he may readily obtain proper course guidance during undergraduate college work by personal contact or writing to the various departments of pharmacology as they exist in medical schools or pharmacy colleges. In some instances pharmacology departments are within dental and veterinary colleges. These departments engaged in training students will probably recommend most academic requirements outlined in this discussion.

At the present time, probably due to lack of acquaintance with the field of pharmacology, few students are totally prepared academically to enter graduate training in pharmacology. However, this is no reason for a bright and dedicated student not to seek pharmacology as a career. A considerable portion of the ideal undergraduate training may be accomplished as an integral part of his graduate program. Unless the student is grossly deficient in subject matter, he can complete the fundamental ideal curricula without spending time beyond the four years which is normally required for a Ph.D. degree in this department. If students in the future have the ideal undergraduate preparation, the time required for the Ph.D. degree may possibly be shortened to three years. Most of our graduate students entering pharmacology have come via a major in chemistry or as pharmacy college graduates. These two areas have more nearly fulfilled the proper undergraduate orientation and are probably the best source of graduate students at the present time. With a better view of pharmacology as a career, certain deficiencies in the course structure of these areas may be selected as electives for proper preparation for entering graduate work in pharmacology. As an example, chemistry students as a rule do not take a course in zoology, while pharmacy students probably lack sufficient mathematics.

GRADUATE TRAINING

The course requirements for graduate work in pharmacology vary considerably from institution to institution. Where the pharmacology department is an integral part of the university, arrangement of course work in related scientific areas is always available. In the department separated from the main campus, the training probably will not be as broad in scope, and greater responsibility for formal course work will reside within the department. Since there are differences in formal graduate training, we will concentrate our discussion on the approach used at Iowa. We do not suggest that our curriculum is superior or even ideal, but it seems to fit best the opportunities and limitations of this uni-

versity. At least our students are enthusiastic about our program as evidenced by their dedication to the fulfillment of their graduate training. We feel that a proof of this enthusiasm is shown by the fact that one can find the graduate students still in the laboratory at midnight. Perhaps an additional factor for their enthusiasm is that we encourage our students to formulate and pursue their own problems. While these problems may not be of profound depth, they certainly stimulate the curiosity of the individual.

A recent additional factor for a student selecting a career in pharmacology is the financial support now afforded by the Trainee Grants of the National Institutes of Health. No longer does the graduate student need to accept outside jobs in order to support himself financially. Certainly, a student cannot perform his best when he is continually harassed by monetary difficulties. The Trainee Grants of the Federal Government have removed the headaches of the departments that previously were harassed by the responsibility of obtaining year-to-year support. The program at this institution is geared in number of students to the size of our staff. We firmly believe that no staff member can sponsor more than three graduate students and preferably only two. No staff man can do justice to his graduate students unless he is readily available for informal consultation; and such student conferences should be more general than just details about the student's research project. The student should be made to feel that he is an integral part of the department.

When the student enters the department for graduate training he enrolls in the fundamental courses, namely, pharmacology, biochemistry, and physiology. After a period of a month or six weeks the students become acquainted with each staff man and his particular area of interest. With the diversified interest of the staff we have as yet experienced no difficulty in overloading any individual staff man. While the student spends most of his time doing research in the sponsor's area of interest, he receives a rotational period with all the other staff men. Thus he familiarizes himself not only in one area, but becomes acquainted with techniques in other areas of research.

We are interested primarily in training leading to the Ph.D.; however, we do require our students after a two-year period to obtain a master's degree. We realize this is not of great importance to the student, but it is an invaluable aid to the staff in evaluating the scholarship of the student. For the master's degree the student takes both a written and oral examination, and he must have completed a significant research problem. If the student's performance is now judged to be adequate, he is encouraged to continue his training.

Entering graduate students find that the course work for the first two years is rather rigidly outlined, and must be completed with an average grade of B or better. The courses are medical pharmacology, physiology, biochemistry, and the special two-semester-hour courses offered within the department. These special graduate courses taught within the department are chemobiodynamics (the content of this course is primarily concerned with structure activity relationships); bioassay and statistics (emphasis on small sample statistics and proper experimental design); methods in pharmacology (techniques used for drug evaluation); drug and cell catalysts (emphasis on drug metabolism and enzymology).

In addition there is a continuing weekly departmental seminar. The above basic courses, at this school, require two years for completion and with a thesis lead to the master's degree.

For the student continuing beyond the master's level we require differential and integral calculus, qualitative organic chemistry, physical chemistry, and histology. We no longer require French and German languages; instead, our students usually substitute courses in mathematics and electronics. We certainly recognize the importance of languages, but the one-semester-hour course offered to the graduate students simply is not sufficient to provide a reading knowledge of the subject. With these fundamental courses as a background, further course work is directed to pursuing courses more adapted to the field of the student's interest. For example, if he wishes to pursue drug metabolism we recommend courses in bacteriology and more advanced courses in biochemistry. If his interests are the central nervous system, he pursues course work in neuroanatomy and neurophysiology. In whatever he decides to specialize, the university offers courses that he may pursue with profit, be it pathology, English, advanced electronics, etc. These courses and many more are offered and are available to all students within the university curriculum.

Perhaps we are unique at Iowa in having a staff man that holds a joint appointment in anesthesiology. Anesthesia is an example of applied pharmacology at its best. Each of our students spends two weeks in anesthesiology as an observer. He becomes acquainted with application of laboratory research as well as clinical questions that await laboratory solution. In addition to the time spent in anesthesiology we are instituting a three-month period of observation and training in the medical cardiovascular laboratory. During this three-month period each student familiarizes himself with the various techniques utilized in the respiratory and cardiovascular section. Since this period is during the final year of training, the student becomes intimately involved in carrying out these techniques.

In addition to course work and research each student assists in the departmental teaching. During the first and second years he assists in the laboratory. The advanced student takes a more active part in the teaching, such as conducting laboratory didactic sessions. In the final year the student presents a few lectures to the pharmacy and dental students. No student is assigned teaching duties to the extent that it will interfere with his best efforts in course work and research. No student has ever complained of overassignment. Perhaps not all of our students will enter teaching, but the ability to teach and present clearly a given subject is equally important in industry or government.

Besides the necessity of maintaining a high scholastic record, we give written and oral qualifying examinations one year previous to graduation. The student must accumulate thirty semester hours after satisfying the qualifying examinations. The final examination is an oral examination over the content of the candidate's thesis. In the matter of thesis work, the student is allowed considerable latitude. He may pursue a single research project in all its ramifications, or he may select two or three shorter projects. We prefer the latter, since we feel it is a good boost to the student's morale to write and publish at least two papers before he receives his degree. The various projects do not necessarily need to be related research projects.

Within limitations of our available travel funds, we encourage our graduate students to attend and present papers at either the Federation Meeting or the Fall Meeting of the Pharmacology Society.

After the completion of the above formal training the student should be ready to take his place in teaching, industry, or government and make contributions to his science.

GRADUATE EDUCATION IN PHARMACOLOGY

TOM S. MIYA

The late Dean R. A. Lyman once said (1): "What Pharmacy needs is a lot of young men who will stick their necks out." Although I do not intend to stick my neck out, I hope that this article is taken in the spirit in which it is written; that is, an attempt to upgrade graduate education in pharmacology among schools of pharmacy.

ACADEMIC PREPARATION FOR GRADUATE STUDY

The late Dr. Leroy D. Edwards outlined the "Minimum Prerequisites for the Undergraduate Pharmacology Course" during the Teachers' Seminar on Pharmacology held at Purdue University in August, 1951 (2). The recommended minimum requirements in the biological field were set forth as (1) General Biology—eight semester hours, (2) Vertebrate Anatomy and Histology —four semester hours, (3) Physiology—six semester hours. There is little one can add to these requirements as far as the biological sciences are concerned. General biology and physiology are required courses in the pharmacy curriculum, although many of these courses are probably still being given at substandard levels. Vertebrate anatomy and histology are not required subjects in our current curriculum, hence they should be taken as electives.

From my observations, aside from the courses listed above, students can better prepare themselves for graduate work in pharmacology by electing courses in organic and biochemistry. Inadequate knowledge in these areas is one of the big stumbling blocks. Basic courses in statistics and physical chemistry also facilitate the work of the student when he enters graduate work. Courses in psychology and sociology are also important in light of the tremendous amount of work currently being done on mental illness. One of the glaring deficiencies of many college graduates is their inability to express ideas or results in a clear, concise manner. Perhaps part of the blame should rest on the shoulders of instructors who are partial to objective, short-answer questions on their examinations. In our courses in pharmacology to the undergraduate students we often get the complaint "but we are not accustomed to essay-type questions" or "I know the answer, but I just can't put it down on paper." Some of these students find their way into the ranks of the graduate school. My advice to students who wish to continue with graduate work would be to practice the art of communication; additional work in English composition or speech would not be out of order. A scientist and research worker must not only be able to get results in his laboratory but also be able to transfer his ideas and data to others in a nonobfuscate manner.

Needless to say, in the present crowded pharmacy curriculum it is impossible to elect all courses which will be beneficial. The five year curriculum, which is discussed elsewhere in this symposium, should allow the student to choose more electives which will better prepare him for graduate study.

THE GRADUATE CURRICULUM IN PHARMACOLOGY

Unfortunately, there is still a great deal of misunderstanding about the type of graduate education in pharmacology being offered in schools of pharmacy. Before continuing with a discussion of a graduate curriculum, it may be advan-

tageous to review first some of the facts and opinions expressed on questionnaires submitted to industrialists by Dr. Rudolph Blythe and published in this journal (3).

It is interesting to note that the industrialists view course work as highly important in judging the prospective employee—weighting this phase of the candidate's training almost 50 per cent.

It is no wonder then, that with the misunderstanding which exists, certain pharmaceutical firms and others take a rather dim view of Ph.D.'s from pharmacy schools. In the same survey, two comments made by directors of pharmacology or biological sciences, although only opinions, are worthy of mention here. "(1) Ph.D. education in pharmacy schools is given in an undergraduate atmosphere. Lack of graduate faculty is a glaring weakness. (2) Ph.D.'s from pharmacy schools cannot compete with Ph.D.'s and M.D.'s from medical schools as far as pharmacology is concerned. This weakness could be overcome if the student would take certain courses in the medical schools; for example, comparative anatomy, physiology and pathology." Whether these opinions are right or wrong, they certainly indict the graduate training program in our schools of pharmacy without trial.

I cannot help but think, however, that some of these untoward remarks have been brought on by the lethargy of some of our colleagues. Until the last few years, the number of pharmacologists from pharmacy schools attending either the Spring or Fall Meetings of the Pharmacological Society could be counted on less than the fingers of one hand.

In discussing the graduate curriculum I would like to write about our own. It is only natural that we believe our curriculum to be a sound one. I believe that each institution has its own peculiarities and that full advantage should be taken of the staff and course offerings inside and outside the pharmacy school when such are available. We are fortunate at Purdue in that many related areas are represented by renowned men in their particular field. The soundness of our curriculum is, I believe, reflected in the success of our graduates in industry and in various teaching and research institutions in the United States, Canada, and elsewhere. An increasing number of our graduates are gaining membership in the Pharmacological Society.

General and applied pharmacology are offered each year. The advanced courses are offered one each semester, for example, Biological Assays (semester one) and Screening Methods (semester two) during odd-numbered years. The other two courses are offered during the even-numbered years. The course

TABLE I. COURSE OFFERINGS IN PHARMACOLOGY AT PURDUE

Courses	*Credit Hours*
General and Applied Pharmacology (2 semesters)	6*
Biological Assays (Biometry)	4
Screening Methods (Theory and Method)	4
Advanced Pharmacology	4
Advanced Toxicology	4
Seminar	
Special Problems	
Research	

* Dual-level courses required by seniors. All majors must take the full complement of courses or their equivalent, with the exception of Special Problems.

contents are too lengthy to describe here, but a brief outline of the courses can be made available to those who wish them. The didactic portion of the courses is supplemented by guest lecturers, for example, from the Department of Psychology, Department of Biophysics, etc. All of our advanced laboratories are given on a once-a-week basis, rather than two short periods during the week. Our laboratory periods begin at 1 P.M. and extend as long as the occasion demands. It is not unusual to have students working until 8 or 9 P.M. Elaborate laboratory write-ups are required of each student. At least once each semester the students are evaluated by an oral examination on their laboratory and course work. It has been the experience of this department that the capabilities and limitations of the student can be more readily evaluated by this means. Written examinations are also given at least once each semester.

The *minimum credit requirements* for the M.S. degree are twelve, six, and six credit hours, respectively, for the major and two minors. For the Ph.D. these requirements are twenty-four, twelve, and twelve, respectively.

Although the minors for the M.S. degree are usually physiology and biochemistry (we think these courses are essential for understanding pharmacology), exceptions are made depending upon the student's background. For the Ph.D. degree the balance of his major and the minor subjects is carefully selected, keeping in mind the aptitude and interests of the student. An attempt is always made to develop the student's natural capabilities to their fullest extent.

I would like to re-emphasize the fact that the student should be guided into course work and phases of research for which he has the most natural talent. Course work should be chosen not to learn new technics but to gather fundamental information on which to build. Special technics can be mastered with relative ease, with the exception of a few cases. Students often ask to enroll in many different classes with the argument that new technics can be learned. However, I believe that we have to realize that we cannot teach or learn all the technics which may possibly be required in future endeavors. The choice and the total number of courses should be dictated by the needs of each individual student. Some students would overload themselves with course work and neglect research if allowed to do so.

It can be noted in Table II that Isotope Tracer Technic is required by all of our students along with basic statistics, biochemistry, and physiology. I believe that we are reaching a point now where a Ph.D. in pharmacology is expected to know the fundamentals of this valuable technic. One needs only to thumb through the publications to realize the overwhelming use of this technic. In our own case, we are fortunate to have a Department of Bionucleonics which works closely with us and others on the campus who are interested in employing isotopes for certain phases of research.

Research. Since graduate degrees are research degrees, research is encouraged early in the student's career, and those who can meet the demands of course work and research are pushed to their capacity. By following such a plan a seriously deficient student can be asked to terminate his graduate career without delay. An occasional student may be "saved" by careful guidance. The tendency to carry a weak student through the M.S. degree and then inform him that he is not qualified to further pursue graduate work should be condemned. The professor and the student have wasted both their time and money.

Although the primary responsibility for the guidance of the student's research falls upon his major professor, a research committee composed of professors

TABLE II. COURSES MOST OFTEN TAKEN BY PHARMACOLOGY MAJORS

Courses	*Credit Hours*
Microscopic Technique and Histology	4†
Pathology	4†
Introduction to Endocrinology	3
Principles and Techniques of Endocrinology	4
Experimental Animal Physiology (2 semesters)	4* and 4*
Biophysics	5
Biochemistry (2 semesters)	3† and 3†
Advanced Biochemistry	3
Biochemistry and Proteins	3
Biochemistry and Nucleic Acids	3
Biochemistry and Metabolic Disorders in Animals	2
Glass Working	1
Physical Chemistry	4
Organic Chemistry (2 semesters)	3 and 3
Chemistry of Amino Acids and Proteins	3
Chemistry of Enzyme Action	3
Audio-visual Aids for Teachers	3
Introduction to Measurement and Evaluation	3
Statistical Methods	3*
Advanced Statistical Methods	3*
Analysis of Variance and Covariance	3
Design and Experiments	3
Organic Medicinal Products	3‡
Instrumentation (2 semesters)	3‡ and 3‡
Isotope Tracer Technic (Theory and Laboratory)	4*‡
Manufacturing Processes	4‡
Alkaloids	2‡
Chemotherapy	2‡

† Required if deficient.
* Required by all majors (Ph.D.) in pharmacology.
‡ Offered in the various departments of the School of Pharmacy.

in areas related to the research meets with the student from time to time to discuss the progress of the work. Many times, the most helpful suggestions come from persons who are not so "close" to the problem. On the Ph.D. level the student should be expected to solve many of his own problems; however, close contact should be kept so that the student does not go too far astray. The development of initiative and thought process should be a part of the graduate training.

Conferences should be held at least once a week with the student, if not more often, to discuss the progress in his work. We regularly require written quarterly reports from the students. Such reports enable the student to evaluate his own progress and also facilitate the final thesis writing.

Formal Course Work vs. Seminar Approach. It is my opinion that there is no substitute for a good, well-organized, formal course offering. In seminar-type courses, breadth and continuity are lacking. There is a place, however, for seminars where a free exchange of ideas among the students takes place. In such seminars the instructor should act merely as moderator and lead the students to the desired answer or conclusion.

Foreign Language Requirement. For the Ph.D. degree two foreign languages are required (German, Russian, or French). One of the language requirements may be satisfied by six credit hours from an approved list of courses. The tremendous amount of time spent by the student to master a language could be more fruitfully used in research or additional courses, e.g., statistics; hence we practice the substitution of six credit hours for one of the languages. I believe a more desirable plan would be to require a two-semester course in German where the student can ground himself well in the fundamentals. Such a course can be taken along with his other work and will enable him to scan the literature, if necessary, with the aid of a dictionary.

Budget. The budget is a universal problem with all of us. The fact that the teaching of pharmacology to both undergraduate and graduate students is a highly expensive venture must be faced. There is not only the problem of adequate equipment, but also the cost of animals for teaching and research. The "good ole days" when courses could be taught and research could be performed with a "Bunsen burner and a beaker" belong in ancient history. With the tremendous strides being made in electronic as well as other types of equipment, the budget must be adequate to equip and run the laboratory. Any institution engaged in a graduate training program is duty bound to familiarize the student with the newer research tools of his profession.

The graduate curriculum discussed in this paper is that followed at Purdue and incorporates some of our basic philosophies. I should like to point out that the curriculum outlined here may not be applicable to every institution, but it has served us well. As mentioned earlier, each school has its own peculiarities, and the training program should be established to take full advantage of what is available on the campus.

I would like to conclude my discussion by bringing up a subject which has disturbed me greatly. I am sure that many pharmacologists in the various schools of pharmacy are doing significant work outside of their classroom teaching duties in the form of research or other academic endeavor. Unfortunately many of these men are never seen nor heard from. (Perhaps I am wrong in assuming that most of our colleagues are engaged in research and other scholarly activities. At any rate, it is high time that we begin to do something.) I believe that it is imperative that we get to the meetings where pharmacologists congregate—to meet, exchange ideas, and to let others know what we are doing. Whatever the reason for avoiding the common tramping grounds of the pharmacologists, the situation must be remedied immediately. I feel strongly that the future of graduate training in pharmacology in schools of pharmacy depends upon it. I would go so far as to say that a graduate training program in pharmacology should be relinquished if the professor is not interested in associating with others of his profession. Above all, it is grossly unfair to the graduate student under his direction and detrimental to all of us.

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AN APPRAISAL OF GRADUATE EDUCATION IN PHARMACOGNOSY

ARTHUR E. SCHWARTING

The systematic accumulation of knowledge in the natural sciences, which began several hundred years ago, was never fully assimilated within the science of pharmacognosy. The position of this discipline parallels pharmacy education which only now is emerging from a pattern that was typically a technology. The order within pharmacognosy traditionally had as its objective the assembling of qualitative data along a narrow line which did not lend itself to creativeness. This objective always filled the immediate need but conceded only a limited integration of pertinent scientific advances from basic science. Casual understandings of genetics, biochemistry, phylogeny, etc. were considered satisfactory for the professional; the great demand was for an individual qualified to identify plants and plant parts. Very few fundamental concepts or rules distilled from these experiences, and it was only occasionally that a scholarly specialist gave a new direction to the near-static science.

Yet, pharmacognosy has been defined as pharmacy's specific and peculiar contribution to the field of science. It is that, but to remain so it must provide teachers and researchers with an education and with objectives that reach into the frontiers of scientific inquiry. A science which can only express itself through known facts will not survive. It must possess a foundation of knowledge through which new facts may be predicted. Any science, fundamental or applied, must be so established that when observations do not fit into the structure of known facts, the base must be strengthened or enlarged.

A new vista is emerging for pharmacognosy. Although science and industry have expected little from pharmacognosy, the renovated science is now providing or must provide the scientist capable of performing one or more of three functions. These are as follows:

1. An ability to evaluate and define the population of the plant kingdom as structures and as cellular units possessing chemical potential.
2. Be capable of manipulating plants and cells in productive processes.
3. Engage in isolation and characterization operations of cell constituents.

These responsibilities then became the objectives in graduate education. The fundamental objective of a graduate program in pharmacognosy is the development of scholars who have the ability to function critically and creatively in the areas suggested above. To accomplish this intention requires a change in perspective among many pharmaceutical educators.

The undergraduate program, requisite to pharmacognosy, must be maintained and strengthened with substantial courses in the biological sciences, chemistry, and mathematics. The present curricula which embody terminal,

survey, or pharmacy adapted courses in these areas are short-circuiting the development of the full scientific personality. The undergraduate student, who can early determine his objective towards a career in pharmacognosy, should not only substitute for such courses but should choose science electives from among such courses as genetics, taxonomy, plant physiology, calculus, statistics, qualitative organic chemistry, and biophysics.

The graduate school applicant should be an honor student or possess no less than a high B average in the undergraduate program. The graduate program for such candidates should be planned and carried forward according to a pattern which seeks the following: First, a period of development during which time the student begins the consolidation of knowledge. During an interval representing the equivalent of a year of enrollment, the student should devote one-fourth of the time to laboratory research which will permit both staff- and self-appraisal. The subject matter of course work, during this period, should be that which will strengthen the background and also initiate a broadening of the outlook. These courses are as follows: one year each of botanical taxonomy and biosystematics, biochemistry, advanced organic chemistry, and departmental seminar. It is important that the student prepare himself further by reading and study beyond the usual course requirements. Upon conclusion of this phase of the program, and upon an over-all evaluation, it should be determined whether the student should conclude his graduate program with M.S. degree candidacy or should plan for work at the Ph.D. level.

The second period in the career of the scholar is that time in his Ph.D. program where he grows in scientific knowledge to the extent that he can demonstrate independent thought in writing and laboratory experimentation. The curriculum necessary to attain this capacity is not uniform and is dependent upon the function(s) cited earlier. If they are to include the first and second capacities attention will be granted to the following subjects: plant physiology, genetics, mycology, and biophysics. Techniques and basic understandings should be acquired in plant breeding, cell culture, instrumentation, and qualitative organic chemical methods.

If the candidate is to pursue functions described in the third particular above, the course of study will comprehend chemical and physical-chemical courses including the chemistry of heterocyclic compounds and advanced physical chemistry. This pattern may be obtained in lieu of the courses on genetics, mycology, and plant breeding cited above.

The third period in the education of the pharmacognosy major is the solution of a research problem and the thesis preparation.

The breadth of scientific attainment provided by curricula sketched above will contribute individuals of full stature and potential. The programs transcend conventional practices and encroach upon curricula which have been model for the education of the "plant chemist." It is significant that interest and enterprise in natural products by pharmaceutical chemists is declining, and attention must be given to this aspect of scientific endeavor by pharmacognosists.

Graduate education in pharmacognosy is plagued by several conditions and practices which deny an aggressive and purposeful program. I am not aware of a staff that is adequate to the development and maintenance of

an effectual program in pharmacognosy. Pharmacognosy teachers ordinarily fulfill multipurpose roles in both graduate and undergraduate curricula, and their effectiveness in either becomes insufficient. The aggressive recruitment of graduate students to provide positions for the graduate assistantship program repeatedly lends itself to the enrollment of students of mediocre ability and potential as well as creating, in some instances, the graduate program itself. The time has long passed for obtaining a method which will appraise capacity and objectives of graduate programs among our schools and colleges.

It is urgent that pharmacognosy graduate education look seriously to the possibility of the establishment of an institute or center, within a university, where study and research can be pursued at the highest level of intellect and administrative understanding. Such an institution, through its permanent staff, visiting lectureships, and postdoctorate study, would fill a void that would not only relieve the profession of the many attenuated graduate programs operating today, but provide the milieu in which the science can develop its highest potentialities.

We, in the United States and Canada, must plan to receive large numbers of students and scholars from other countries, and we must, at the same time, recognize that a solemn responsibility rests upon us to serve them to the best of our ability and on the highest educational and spiritual levels.

Moreover we must also recognize that we can profit greatly by sending substantial numbers of carefully selected students and staff members abroad.

Edward H. Kraus, Am. J. Pharm. Ed., 9, 549 (1945)

GRADUATE EDUCATION IN PHARMACOGNOSY

H. W. YOUNGKEN, JR.

It is challenging to think of graduate training in pharmacognosy, for perhaps at no time during the past decade has this pharmaceutical area presented more possibilities in teaching and research for a graduate student than at present. This attitude toward an older subject with a newer face has come about in part because of a newer interest in cellular activities as a source of modern pharmaceuticals and in part because of an academic curiosity in the intricacies of the cell and tissues as chemical factories. Like similar broad interests in other applied biological and chemical sciences, this curiosity takes the student and researcher into a world of living organisms, plant and/or animal, and laboratories with modern equipment with which to explore their secrets. Modern advances in instrumentation and various tools of research (tissue culture, chromatography, radioisotope techniques, spectroscopy, etc.) have opened up new avenues of exploration in pharmacognosy, more specifically for obtaining a fuller knowledge of the natural sources for drug substances at the cellular level.

Whereas graduate pharmacognosy has in the past dealt largely with descriptive lessons of plant and animal morphology, taxonomy, and analytical chemistry, the published literature in the field today has a greater flavor of experimentation, particularly that dealing with plant biochemistry, plant and animal physiology, and their chemistry.

This is not to say that there is no longer need for specialists in the more descriptive aspects of botany in pharmacognosy nor interest in the same. Surely as all kinds of plants from unicellular microbes to the most complex phanerogams are investigated for newer drug compounds their identification, description, and ecology must be thoroughly established.

It is also important to recognize that botanical (zoological in the case of the animal kingdom) nomenclature and terminology frequently change in accordance with the modern advances in these sciences. It is largely through the contributions of some pharmacognosists that such changes affecting the status and standards of raw drugs and their chemistry are brought up-to-date in the pharmaceutical literature.

A very definite need then exists for qualified personnel with training in these botanical and analytical areas of pharmacognosy. A broadly trained teacher in pharmacognosy should have an awareness of the techniques and problems associated with the classical descriptive aspects of botany, plant analysis, and microscopy.

The fact remains that newer and broader objectives are being established for graduate education in pharmacognosy. The graduate student in this area now generally seeks a thorough knowledge of the chemistry and biochemistry (physiological chemistry) of cellular components to meet these objectives, and often of the ancillary pharmacology related to them.

Furthermore, contemporary research in this area may include the development of chemical and/or physical instrumentation and/or newer analytical tools to fit a special purpose. Thus, it is difficult to define the graduate program in this subject in narrow terms, and we must accept the fact that no formula of course work will be satisfactory for all concerned. That

graduate study and research in pharmacognosy is biological and chemical in nature is universally recognized, and, therefore, for proper preparation the student must have a thorough grounding in several basic courses of these areas both at undergraduate and graduate levels.

In keeping with modern trends in all sciences regardless of how one defines them, each includes several practical applications of others. There is no longer any hard and fast separation of sciences into specific areas, no fixed boundaries nor any rigid distinction between pure and applied science except perhaps in the mind of the individual scientist. It is good for graduate students to feel this way about science and to understand that, unlike the undergraduate program, a greater degree of flexibility exists in the graduate course. It is a custom-made program in accordance with the student's interest, background, and abilities.

But we recognize in a graduate program that rather abstract interests, as demonstrated early in the career of a graduate student, should be soon crystallized to a point so that by the time he reaches candidacy for the Ph.D. degree he knows pretty well in what direction his research is to go. In other words, it is well for graduate teachers in pharmacognosy to present the broad aspects of the science and to encourage intercourse with allied basic and applied sciences early during the program. At the same time, by skillful counseling, the student should soon develop a more specialized interest in some special phase of pharmacognosy. Certainly his or her ultimate goal is the thesis research, an original contribution to the advance of knowledge. It is the purpose of effective counseling then to ascertain as soon as possible what this research interest may be and how soon the candidate is ready to develop it in the laboratory.

After all, a lifetime can be devoted to any branch of science without the mastery of it. The graduate degree program is a training program at an advanced level. It, among other things, should develop a creative scholar, but should not be regarded a period in which to produce the finished scholar. Therefore, it is the important responsibility of the major professor or the student's committee to guide him carefully through a period of course work into a period of original research and in as reasonable a time as his capacities permit.

PREPARATION FOR GRADUATE STUDY IN PHARMACOGNOSY

We have said that a graduate career in pharmacognosy is a challenging one and that the biological and chemical nature of this area offers excellent possibilities—particularly for creative minds. What are some of the essential course prerequisites for adequate preparation in the field?

Certainly the bachelor's degree program in pharmacy should at least furnish a satisfactory amount of the basic pharmaceutical aspects of pharmacy and pharmacognosy and the importance of living organisms in the synthesis of drug products, including their biology and biochemistry. The general undergraduate pharmacognosy course should generate interest in the subject *per se* and perhaps stimulate a kind of exploratory or research interest in certain aspects of it as a science. However, it must be said that unless the undergraduate preparation includes adequate university-level courses in *basic* mathematics (algebra, trigonometry), physics, chemistry (through organic and biological chemistry), in college biology (preferably botany and

zoology, one academic semester each), bacteriology, physiology, and in analytical chemical and biological procedures (qualitative and quantitative), the minimum prerequisites directly related to the graduate program will not have been met. Surely other courses of the pharmacy curriculum are vital, especially microbiology, pharmacology, pharmacy, pharmaceutical chemistry, etc. I would stress, however, that since several graduate courses of a basic nature, to be mentioned later, require the strongest preparation in the undergraduate basic chemical and biological sciences, the prospective student should be made aware of this fact at an early stage.

While graduates with a degree in pharmacy who in all ways qualify are most desirable for graduate work in pharmacognosy, I agree with those who also accept qualified students from areas other than pharmacy for graduate work in this science. For certainly students trained as biology, microbiology, chemistry, biochemistry and ecology majors or in certain agricultural science areas may often qualify. I do not believe that graduation from a college of pharmacy or licensure in pharmacy, as desirable as these may be, should be firm prerequisites for the graduate program. Just as the ballet dancer can often be made into an expert ice skater, so, too, can a biologist or chemist with talents for pharmacognosy develop a satisfying career in this area. Frequently, important deficiencies of a pharmaceutical nature can be made up early during the first stages of the graduate years. As Pratt has stated (1) ". . . it is important to attract competent individuals with good fundamental training and fresh, new ideas, even if these individuals do not precisely meet established specific course and minimum unit requirements."

GENERAL AND SPECIALIZED COURSES FOR THE GRADUATE CURRICULUM

A number of graduate teachers in pharmacognosy (2-6) have expressed themselves regarding the need for extensive training in basic and applied plant and animal biology in the graduate program. In addition, Youngken (7) has stressed the need for proper language preparation, and Deno (8) has proposed that some attention be given to the problems of teacher preparation in addition to thorough preparation in biology and certain physical sciences for those who wish to teach pharmacognosy.

Certainly there is no dearth of information regarding in what areas general and specialized courses should be available for the graduate student in pharmacognosy. I doubt that anyone would take exception to the various proposals that graduate courses in several biological and physical science areas should be a part of the student's program. There is also little question that language study, at least two of four languages usually available (i.e., German, French, Spanish, Russian), would be most desirable, or that for the prospective teacher certain courses in teacher training or methods be a part of the program. However, we must not lose sight of the fact that the program is not alone one of advanced courses. It should include emphasis upon creative research, research methods, experimentation, and original research contributions. It should really develop thinking and the spirit of a critical analysis toward the problems in the field. In my opinion, one of the most important objectives of the graduate program in pharmacognosy is to inculcate an academic curiosity in the minds of students, an

inquisitiveness of nature as a reservoir of materialistic things, old and new —how and why!

In my experience with beginning graduate students very few know definitely in what direction each wishes to go toward course work or research in this area. Most have been inspired as undergraduates with the concept that here is a broad biological field with problems in basic and applied research. Most are anxious to do research with drug plants, particularly in such problems as searching higher or lower plants for newer active components or investigating the pathways by which plant compounds are biosynthesized. All wish to learn modern techniques of the laboratory related to pharmacognosy, including a certain amount of physical and chemical instrumentation and histo- or microchemical microscopy. They wish to get behind the research bench as early as possible.

The greatest number of beginning graduate students have obviously had little experience with advanced university courses in the biological and physical science areas allied with pharmacognosy. Usually only the basic required undergraduate courses in biology and chemistry have been completed. Students from the pharmacy curriculum hardly realize the broadness of scope of biology and chemistry as a whole, for example broad aspects of plant physiology in botany and pharmacognosy, the important biochemistry in both sciences, cellular biology in animal physiology, physical chemistry in biochemistry, cytogenetics and phylogeny in biology, or the importance of quantitative and biostatistical measurements as applied to problems in any of these. There are many other examples of such relationships, and it is, of course, expected that the beginning student would not be aware of what these broader aspects of biology, chemistry, and pharmacognosy entail or what relationship they have with all sciences.

I am certain that the same pattern prevails for any field of graduate education in the pharmaceutical sciences. One of the student's early objectives in graduate work is, therefore, to become aware of the general scope of certain sciences allied with his chosen field and the current interest of workers in such fields. One of the signs of the progress of a graduate student is when he begins also to talk authoritatively of the publications of those in several fields akin to his major, and when he can effectively analyze and criticize the research report of someone else.

We have said then that students usually look for guidance in how to get started in a graduate career. One of his first responsibilities is to select his course program. The selection of general and specialized courses for the graduate program should be exercised with care. Time is somewhat limited for any graduate student, and no one can expect, through a large number of graduate courses, to meet all of the objectives. The director, therefore, must guard against the selection of a hodge-podge of improperly related course material just to satisfy credit requirements.

In planning the course program one should select basic science graduate courses which correlate closely with applied aspects of the program, including so far as possible the student's special interest in the major. This special interest is often not known early in the course, but generally can be ascertained following the careful review of research interests in the field by the major professor. Let us select certain examples. If a student shows an interest in cellular morphology and structural relationships of a botanical

type, before getting deeply into graduate pharmacognosy courses which deal with applied aspects of these, he should complete a basic graduate sequence in plant morphology, anatomy, plant physiology, and cytology. The extent of each depends upon how they are scheduled by the university department and whether at the master's or doctor's level. Because of scheduling problems it is usually necessary to engage several of these courses concomitantly with one or more of the pharmacognosy major courses such as microscopy, histochemistry, medicinal plants (including their taxonomy, cultivation, and distribution), plant chemistry, and pharmacognosy techniques.

If a student shows more interest in the chemical and physiological aspects of pharmacognosy, his basic program should at least include a sequence of supportive courses in physical chemistry, biochemistry, advanced organic analysis, cellular physiology, and plant physiology. The major pharmacognosy area would then include *such* courses as instrumentation, medicinal plants, plant chemistry, biogenesis, histochemistry, and pharmacognosy techniques. Again, as with the first example, the extent and time for these would be governed by scheduling problems peculiar to each university and whether at the master's or doctor's degree levels.

In both areas of interest should, I believe, be some work in graduate pharmacology (particularly techniques or biological assay), also biostatistics, and advanced organic medicinals or pharmaceuticals (pharmaceutical chemistry). Certainly common to both when the student is adequately prepared are the less formal research courses in pharmacognosy—special problems, nonthesis research, and the seminar or research conference. The seminar or conference activities serve a very important function, for they provide a discussion or debate, if conducted properly, on issues of the research of others. These should not be limited to those of the major field, but as time permits include participation in seminars of certain allied fields, i.e., botany, pharmacology, biochemistry, or others.

OTHER COURSES

There are other basic and applied courses of a similar nature listed in the graduate catalogues of many universities, and some of these are as important as several previously listed, for example, a sequence in microbiology, bacteriology, or animal physiology. There are also the highly specialized courses related to a pharmacognosy major, for example, hormones, steroids, alkaloids, antibiotics, allergens, pesticides, economic biology, etc. These may be given by any number of qualified university departments in addition to pharmacognosy. Most of such courses are highly factual, and unless emphasis is placed upon phases of experimentation and literature search, these courses may turn out to be merely extended undergraduate courses in facts. They have merit at the graduate level if they can stimulate student thinking along experimental lines, if they are general in scope, and if they are well supported by good literature readings. Certainly it is not necessary that all of such special courses related to pharmacognosy be scheduled. It is better for the program to concentrate on more general courses wherein principles and methodology are learned.

If deficiencies exist in the formal undergraduate preparation, particularly in basic science preparation (mathematics, chemistry, language, etc.), these should be made up by formal courses, or by tutorial methods.

SPECIAL PROBLEMS, SEMINAR, AND NONTHESIS RESEARCH

These aspects of the master's and doctoral programs are the less formal courses and, in my opinion, most important. They represent the "driving tests," the "check out" for originality at the work bench and writing desk. Time allotted to each at the master's level is, of course, limited. Often greater emphasis is placed at this level on formal course preparation and the master's thesis. For example, on a semester system six to nine credits of a total of twenty-five to thirty (two units) may be relegated to the thesis, three to six to special problems, and one or none to seminar. Since special problems courses are usually closely supervised projects of a major professor, there is less time in such a course for a student's original work. Their purpose is to develop techniques, just as the seminar develops literature search, poise, and confidence in expression.

If results of the master's program are superior and the student shows capabilities in other ways for the doctoral program, we are inclined to omit the writing of a master's degree thesis and permit him to use the time for a program of nonthesis research, the preparation of a qualified publication, or additional formal courses toward the doctor's program. I do not wish to lower the importance of the master's degree, for we encourage students to complete the requirements for it. But there are occasions when some students of exceptional abilities will profit most by going directly for the Ph.D. instead of taking time to prepare a formal master's thesis.

The nonthesis research portion of the graduate program means a period for laboratory research on an assigned project. The scope of this informal course is considerably beyond that of the "special problems" course. The student has some supervision, of course, but is much more "on his own." His major objective here is to develop and demonstrate a scientific method in attacking an assigned problem, not merely to learn techniques. Time for this varies, but we prefer to assign from five to ten or more semester credits to this part of the Ph.D. degree schedule. We look for originality in the approach to the research and its instrumentation. A good program in nonthesis research may provide subject for the thesis research which follows; it should, of course, prepare the candidate with the proper attitude and discipline for the Ph.D. thesis research.

BOOKKEEPING FOR THE PH.D. PROGRAM

In assigning numbers of credits or units for formal and less formal graduate courses we are simply keeping a certain kind of academic books. This is an administrative evil and really without much meaning. But we do it in this country more or less to keep records so that the work of the student can be more conveniently appraised by the graduate dean's office. Perhaps it does show a better picture of graduate work loads, gives the student a certificate of accomplishment along the way, and, therefore, in keeping with American traditions for organizing and giving credit for everything, has some justification.

For the Ph.D. program in pharmacognosy, a typical minimum requirement of semester credits from areas of required formal and informal courses might be as follows: These are based on a normal university graduate load of twelve course credits per semester (one unit), a minimum of six semesters (six units or three years), or seventy-two semester credits (counting the

thesis) beyond the bachelor's degree. Formal courses (major and supportive areas) range from thirty-five to forty semester credits, informal courses (special problems, nonthesis research, seminar) eight to fifteen credits, with the total of the two categories ranging from forty-eight to fifty minimum credits (four units). A full calendar year is considered minimum for completing the Ph.D. *thesis,* including research and writing the dissertation. Often more than this time is required, but one unit assigned.

Such a program then means that the student devotes at the very minimum approximately one-half time toward research. We prefer more than this. In reality, when clock hours are calculated for the Ph.D. program, by far the greatest portion of a student's time is spent in research, as it should be! It is common for graduate students in pharmacognosy to devote four to five full years to the Ph.D. study since many serve as graduate or research assistants while so engaged. These activities are valuable, and although they do not enter the record of bookkeeping, are nonetheless important graduate training periods. They add to the minimum of a three year period. In fact, because of the extent of thesis research in pharmacognosy, it is somewhat unusual for a full-time student to complete the entire program in as little as three academic years.

ANCILLARY REQUIREMENTS

The language reading requirement for the degree has been discussed previously in this journal (6). It should be reiterated here that a reading proficiency in at least one language is desirable for the master's program in pharmacognosy. It prepares the student better for the Ph.D. schedule. Two languages, including one for the master's program, are generally required for the doctor's work. These requirements should be completed early during both programs, certainly prior to eligibility for the preliminary (qualifying) examination or period of candidacy for the Ph.D. Pharmacognosy research makes extensive use of German, French, Spanish, and Russian. Therefore, as has been stated previously, consideration should be given to the reading knowledge of at least two of these languages. Certainly students from foreign lands in which English is not the common language should demonstrate reading, writing, and some speaking ability in this language. Special facilities in most universities provide assistance for this, or it amounts to a self-learning process.

Two ancillary "tool" activities—photography and gadgetry—have merit in a pharmacognosy program if time permits. Since photography for the preparation of suitable records of research is such a common tool in many modern biological sciences, consideration should be given to training and a certain degree of proficiency in this area. This technique can be developed by individual efforts within the time of less formal research courses or by the election of noncredit courses when available. Usually it is mastered by self-learning.

Finally, in view of a need to perform a certain amount of gadgetry (carpentry, electrical work, glass blowing, instrument repair, etc.) in experimental research in pharmacognosy, the graduate student should take time during his program to develop some working ability in several of these "do it yourself" jobs. The intellectual attributes of such activities can obviously not be considered in the bookkeeping of the doctorate. On the other hand,

vocational abilities in such tasks often provide the means for success in research and certainly aid the teacher and independent investigator.

With the exception of language proficiency, we would, of course, not require these ancillary areas of experience for the student. However, they help to round out the talents of the man just as continued reading in the humanities, social sciences, and arts contributes to his intellectual status.

CONCLUSIONS

No hard and fast curriculum can be drawn for the graduate program in pharmacognosy. We have undoubtedly omitted various other courses which may be most helpful in a student's program. It is a custom-made program requiring a degree of flexibility depending upon a student's interest, background, and abilities. In addition to work of the major, the program makes use of a large number of selected courses (formal and informal) in supportive basic and applied areas, i.e., biology, physiology, chemistry, biochemistry, pharmacology, and pharmaceutical chemistry. A program is arranged according to the offerings of a university, and the research interests of the student. One cannot, therefore, assign fixed numbers or kinds of courses or credits which will fit all university departments in which graduate work in pharmacognosy is presented.

In general, students basically seek one of two objectives in graduate pharmacognosy, each of which prepares for teaching and either academic or industrial research. These are (1) an advanced training including research in the morphological and phytochemical knowledge of drug plants, or (2) proficiency in the biochemical and physiological* knowledge of drug plant components and their biosynthesis. These objectives may indeed overlap or intermix. Concomitantly with these objectives he seeks an intellectual understanding of the various principles learned in other basic science areas, especially how these may be applied to independent research on academic or industrial levels. Finally, by carefully mastering the scientific method he develops confidence in research and a critical attitude toward the proper evaluation of scientific progress in the world around him.

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* Including pharmacological, where applicable.

PHARMACEUTICAL CHEMISTRY AS A MAJOR FOR ADVANCED DEGREES

WALTER H. HARTUNG

> The rung of a ladder was never meant to rest upon, but only to hold a man's foot long enough to enable him to put the other somewhat higher.(1)

A discussion of advanced training in pharmaceutical chemistry will evoke as many ideas, I dare say, as there are educators. Respecting these, one is reminded of the words of Alexander Pope in his *Essay on Criticism*,

> 'Tis with our judgements as with our watches, none
> Go just alike, yet each believes his own.

This paper is based on my own experiences and the thoughts of ten years' effort as a research chemist with a reputable pharmaceutical firm and twenty-three years as a professor in three different schools of pharmacy. It has been my pleasure to serve as adviser to gifted and talented young men working for higher academic degrees. They are all friends now, and now I have the unparalleled joy of watching them assume responsibility and leadership in the pharmaceutical world, both scientifically and professionally. How much I have contributed to their progress is properly debatable, but it would seem that at least they suffered no irreparable harm from our association.

It may be well to begin at the beginning, even at the risk of repeating the obvious, in order to fix in our minds some of the pertinent background material. First, as a scientific discipline, pharmaceutical chemistry is not isolated, nor in the field of productive scholarship are its approaches basically different from those of science in general; it demands from those who would pursue it enthusiasm, alertness, and dedication as well as intelligence. It may be characterized in the words of Justice Frankfurter as an "area of scholarship (for) departmentalized dealing, by way of manageable division of analysis, with interpenetrating aspects of holistic perplexities,"(2) especially as concerns the health sciences. Second, it can be chemistry at its best, for being concerned with all the phases of the chemistry of drugs and therapeutic agents it is *ipso facto* concerned with a science of health and disease; a glance at the nation's health bill will quickly reveal the magnitude of this effort. Third, as a laborer in the health sciences the pharmaceutical chemist needs a working vocabulary that will facilitate communication with others who are working toward the same ultimate objectives.

The importance of the health chemistries is not questioned by anyone. The almost incredible advances in the health sciences are constantly before us, and one need only look to find the contributions from the chemistry areas. Outstanding teams of research, endowed with considerable versatility as well as competence, are found in universities, in government, and in the pharmaceutical industry; their laboratories are constantly recruiting the talent of maximum competence. Like all science, pharmaceutical chemistry is developing rapidly; perhaps more than half its growth and history have taken place within the lifetime of our average college student (3).

Historically, i.e., in the nineteenth century, the pharmacist-chemist occupied the most prominent role in pharmaceutical and medicinal chemistry, not to mention the fact that he sired much of modern chemistry. Is there any reason to assume that this role has been diminished, unless by default?

Are we going to define ***pharmaceutical chemist*** in terms of an academic pedigree or in terms of function? Which of the following chemical objectives is not pharmaceutical? The isolation, purification, and characterization of the active principle of a crude drug? The determination of its chemical structure? Confirmation of the structure by synthesis? The synthesis of homologs, derivatives, analogs, isosters, and their characterization? The cooperation with the biological scientist and even the clinician in determining optimum properties for therapeutic efficacy? A study of those qualities which lead to favorable stability, formulation, compatibility, etc.? Proper control, qualitatively and quantitatively, whether by physical, chemical, or biological methods, to insure correct dosage and avoid hazards? The study of new processes by which old and new agents may be made available? The physical and biochemical properties, both *in vitro* and *in vivo*? The employment of radioisotopes as healing agents in themselves or as a means for determining the mechanism of drug action? And which, being pharmaceutical, thereby becomes less chemical?

As already mentioned, the health chemistries face a tremendous challenge and cannot bypass any talent, regardless of where it is found. If we are honest we will admit, even if *sotto voce*, that most of the recent progress comes from scientists who do not have the benefit of the conventional pharmaceutical background in their undergraduate training.

The traditional role of pharmacy in the health services is still indispensable. Pharmacy is not superimposed on, it is not an alternative to, but it is an integral part of these services. Were every retail or corner drugstore to close the prescription department and give all its attention to the "front," society would still find a way to obtain in adequate measure those professional services which we expect from the pharmacist. With due recognition of this as one role it must nevertheless be said that in pharmacy professionalism is considerably attenuated. Whether this is desirable or necessary is not the question before us now. It is a fact, fortunate or not, which must be recognized when we think of training for advanced degrees in any pharmaceutical area. Perhaps we cannot get away from attenuation or dilution in the undergraduate curriculum, but such thoughts have no place in a graduate program.

The term ***pharmaceutical chemistry*** does not shine with the luster it merits. We need not discuss the reasons for this here. The fact remains that it is no compliment to have a faculty colleague ask the professor of pharmaceutical chemistry to accept as advisee a student who cannot qualify for a major in chemistry with the comment that the student is "good enough for a degree in pharmaceutical chemistry." The doctrine of ***good enough*** must be shunned as the poison it is. There is no ***consolation*** degree in pharmaceutical chemistry (4).

If we wish to consider the pharmaceutical chemist as one who receives an advanced degree by virtue of major work in a department of pharmaceutical chemistry, then the problem of training or curriculum does not loom large; for the candidate automatically attains his goal when the president of the institution intones momentous words such as "by virtue of my office and the powers invested in me by the board and the vote of the faculty, etc.," and hands out the coveted diploma. However, if we incline more toward the functional concept of the term, then there is a real reason to consider the graduate student's training and program, for as indicated above, pharmaceutical chemistry is not an isolated science, and its borders more often than not merge nebulously with other sciences.

Students who wish to work for an advanced degree in pharmaceutical chemistry come with varied educational backgrounds. This should not disturb us. The undergraduate record should be evaluated primarily for the student's ability and competence. Once this has been ascertained, there is little risk in admitting him to the graduate school, even if there are deficiencies in the undergraduate transcript. Deficiencies can be corrected, usually with more time, if the student is properly advised, and if he is determined on his goal. Surely if even a mediocre candidate for the B.S. degree can be trained to qualify, then there should be no reason to fear that a superior student can overcome a deficiency. We must not discourage any candidate with promise, not that we want large graduate enrollments but because pharmaceutical chemistry as a health science needs all the talent which is willing to volunteer; furthermore, the association of students with varied undergraduate heritages with each other tends for less parochialism in their outlook.

From the numerical point of view we are much more interested in the applicant who presents an undergraduate degree in pharmacy. It will be agreed, I think, that for more pharmacy schools the undergraduate instruction in the basic sciences is improving. Probably no undergraduate science major receives so broad a foundation; this puts the good pharmacy graduate in a favored position to pursue advanced training, particularly in the health sciences. The pharmaceutical chemistry major coming from a school of pharmacy probably will be deficient in mathematics, and some schools do not offer physics. These will, of course, have to be taken promptly. Perhaps when the pharmacy course is extended, schools will make it possible for the student who has aspirations of becoming a graduate student to take such courses as electives for the B.S. degree.

The undergraduate student who contemplates doing advanced work in pharmaceutical chemistry is advised to note the following:

(i) Practice the art of communication. The student who in an examination answers the whole question and nothing but the question affords his teachers much pleasure. The student who does not know the rules of grammar and the spelling of simple words is a vexation and a trial.

(ii) If you have trouble with mathematics, think twice about taking graduate work and then, unless there is some compelling reason, decide not to take pharmaceutical chemistry.

(iii) By all means take a good course in college physics. The roles of electricity and magnetism and mechanics in health are becoming better understood. Physical principles as employed in, say, instrumentation, are assuming increasing importance.

When the student sets up his program in the graduate school his first concern must be for the basic courses. If there is a deficiency of any kind in the basic chemistry, its rectification must be the first order of business. The same holds true for mathematics, as is more likely to be the case with the pharmacy graduate. An undergraduate prerequisite is not to be looked upon as a course to be taken sometime before the advanced degree is awarded, but as an undergirding for the advanced courses and for its importance to the dissertation. For example, calculus is not required for the Ph.D. degree. It is a course in mathematics which pharmacy students usually take only by special effort. It is a prerequisite for physical chemistry. Some may argue that physical chemistry should not be required, but the fact remains that the pharmaceutical chemist who attempts

to interpret for example, mechanisms and kinetics of reactions, whether they be in terms of deterioration of formulations and determination of shelf-life of a prescription or in terms of drug action, will be irreparably handicapped without understanding the principles of physical chemistry; and even the good student will comprehend physical chemistry better with adequate mathematical foundation. Let us not overlook the significance of the *pre* when it appears before ***requisite.***

The foundation for an advanced degree may be likened to the foundation for a building. Jesus said (Mat. 7, 24) the wise man builds his house on a rock and not on unreliable sand. Foundations are similar in that they are ponderous, usually hidden from view and not esthetic, but they must be more than adequate to support for all time and all possible eventualities any structure that may be built on them. Louis Pasteur, who told us that "chance favors the prepared mind," was able to introduce into science stereochemistry, with all its ramifications, and microbiology because he had adequate intellectual and mental foundation on which to build his career as need required. He did not invent fermentation or infection; he explained them and opened the way to their control. Thus, without adequate foundation training, specialized and high-sounding course titles open "only to graduate students" lose their full value. To take a basic course after completing the special and advanced courses is like adding reinforcing to concrete which has already been poured (5).

Candidates for the Ph.D. degree in our department at the Medical College of Virginia are expected to show evidence of their proficiency and ability in comprehensive written examinations covering the following four major areas: (i) inorganic and physical chemistry, (ii) analytical chemistry, including qualitative analysis for ions, organic analysis, quantitative procedures which in turn covers drug and official assays, (iii) organic chemistry, and (iv) medicinal chemistry. That is, we expect our students to know chemistry but put special emphasis on medicinal products (6).

An approximate division of the student's effort and time, assuming that there are no deficiencies or other prerequisites to make up, will call for about 30 to 45 per cent in didactic and laboratory course work in the major; perhaps 35 per cent or more devoted to the dissertation and the research on which it is based; and the remainder, not less than 25 per cent, for the minor.

Subject to the qualifications already stressed, little need be said about individual course titles in the major. Any course will mean as much or as little as the professor chooses (7). We see this in the emergence of *physical pharmacy;* some educators are designing programs to fit the meaning of the term, while others, it would appear, are using this new terminology to perpetuate old notions. One cannot avoid alkaloids in a lecture course on heterocycles, and one cannot dismiss the chemistry of heterocycles in alkaloids. The chemistry of medicinal products may be presented effectively in any one of several ways, e.g., as natural and synthetic medicinals, on the basis of structural relationship, or even with a pharmacological classification. It is fortunate that all graduate schools do not offer identical courses. These differences, nevertheless, make it advisable for the prospective student to examine the offerings of the various schools in order that he may have some assurance that he will get what he is looking for.

The minors comprise a substantial portion of the student's graduate effort and investment. They should not be spread too thin nor over too wide an area.

They should be selected with the student's preferences in mind, and they must serve as a substantial third leg of the tripod on which he hopes to build his subsequent career.

As already mentioned, one of the pharmaceutical chemist's most useful qualifications is his working vocabulary in the biological and medical sciences (8). He can effectively remove the hiatus that too often exists between the "straight" chemist and his colleague in the biological sciences (9). Thus our student will do well to acquire an appreciable degree of expertness in some biological science. He may, for example, select, depending on facilities and opportunities open to him, from physiology, pharmacology, microbiology, botany, biochemistry, and the like. Unless he wishes to increase his minors more than usual, he should not select from more than two, for here also he should not sacrifice intensity for extensity.

If the student is inclined toward work with new formulations, prescription problems, and dosage forms, he will do well to concentrate on mathematics and the sciences dealing with heterogeneous systems. He will thus be in a much better position to understand both qualitatively and quantitatively the dimensions of his problems and thus come to a more prompt solution (10).

It is quite impossible to conceive of any situation where organic chemistry can be justified as a minor. It is merely an intensification of the major, unless, of course, there be cases where the emphasis is *pharmaceutical* rather than *pharmaceutical chemistry;* the latter is not inferior chemistry. Or perhaps the student is concentrating on physio-chemical principles, or even leaning toward biophysics; then, to be sure, a minor in fundamental organic chemistry is justified.

The pharmaceutical chemist, engaged in learning about all the chemical processes of health and disease, confronts the most interesting challenges. For example, let him take a drug in its neatly labeled container as found on the shelf. Has this been prepared synthetically? Or may it have been isolated from botanical or animal tissues? Was it perhaps prepared by some microbiological process? What was involved in getting it into its neat form? What are its properties as a chemical entity? Where does it stand chemically, pharmaceutically, therapeutically, with respect to homologs and analogs? How does it help the patient? What is the optimum manner of administration? What are the chemical mechanisms by which it produces its favorable result? Are conformation or stereochemistry important? May some of the beneficial effects be attributed to physical properties? To kinetic behavior? To degree of dispersion or solution? To pH? What are its antagonists? Are there any synergists? To discover and contribute to answers to questions like these is a rewarding experience.

In recapitulation it may be said that pharmaceutical chemistry is chemistry, and precisely because of its emphasis on drugs and therapeutic agents, which includes an understanding of their biological properties, it fills a definite need in the health sciences (11). It fills a lacuna that now too often exists. The borders where it joins other sciences are not always clearly definable; hence, it must be versatile and adaptable. If these facts are kept in mind, then curriculum problems in the graduate school become less formidable. The vista before us is not narrow or shallow but rather as one of endless broad acres of deep and fertile soil inviting cultivation by the bold, the vigorous, and the enthusiastic; the results will be proportional to our assiduity.

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(4) This downgrading has been encountered in several forms. I shall mention two. A candidate for the Ph.D. registered at the Employment Clearing House of the American Chemical Society as a pharmaceutical chemist. The attendant first blinked his eyes and then, noting the applicant's qualifications, advised him to call himself a biochemist. Another sought a rating with the U.S. Civil Service Commission; the rating office wanted to consider his doctorate, because it was in pharmaceutical chemistry, as equivalent to the M.S. degree.

(5) The "most unforgettable" transcript to come to my attention was that of a young man who already had his M.S. degree in pharmaceutical chemistry and a semester or so beyond; that is, he was about half way toward his doctorate. Letters spoke highly of him and his ability. But there was no record of any college mathematics, elementary college physics, and, of course, no physical chemistry. He was probably concentrating on his thesis effort without benefit of these courses which, even under the best of time adjustment, would have required at least two additional years.

(6) Our students do not want for offers to work in formulation research and product development. But some of them insist on chemical research. Two students, not receiving offers to work in the chemical laboratories of pharmaceutical industry, accepted offers to work in nonpharmaceutical research laboratories, thus, in the words of the Reverend Dr. Harry Emerson Fosdick, "Making the most of their second best." Efforts to get them back into pharmaceutical areas of activity have been to no avail; the men themselves are happy, receiving regular salary increments and promotions.

(7) Goethe has Mephistopheles say,

Schon gut! Nur muss man sich nicht zu ängstlich quälen!
Den eben wo Begriffe fehlen,
Da stellt sich ein Wort zur rechten Zeit ein.
Mit Worten lässt sich trefflich streiten,
Mit Worten ein System bereiten,
An Worte lässt sich trefflich glauben.
Von einem Worte lässt sich kein Iota rauben.

(8) At a recent symposium of the Division of Medicinal Chemistry a director of research for a well-known pharmaceutical firm publicly lamented the inability of the chemist engaged in the synthesis of new drugs to appreciate or understand the terms used in the biological evaluation of his products.

(9) The president of a pharmaceutical firm which has now lost its identity by merger, speaking about the company's research program, referred to Dr. ———, the director of research and holder of a doctorate with pharmaceutical chemistry major, as "ideally suited for the job. He understands the pharmacist, the pharmacologist, the bacteriologist, the biochemist, and he appreciates the problems of medication." It should be added, of course, that Dr. ——— has the temperament and personality for such an assignment.

(10) A doctorate in pharmaceutical chemistry, whose undergraduate training was in chemical engineering, after a year of postdoctorate work in physical biochemistry, joined a pharmaceutical research laboratory, where he worked effectively producing formulations of new medicinal products discovered by his other research colleagues. He soon was given the responsibility of project leader. He is now with another and growing firm, and he has full responsibility for all pharmaceutical research, that is, for new formulations and dosage forms.

(11) A professor of organic chemistry who is internationally known for his original and literary contributions to medicinal chemistry complained to me that his advisees may not, by rule of his graduate school, take courses in pharmacology for credit, even though the university has a good medical school.

If we want to be recognized as professional men, we must do business like professional men, and act like professional men. We must dress like professional men, talk like professional men, conduct ourselves like professional men—we must be *professional men. No amount of agitation on our own part will bring us the recognition we seek and which is our due. Our own conduct and attitude will determine our status.*

John A. Goode, Am. J. Pharm. Ed., 9, 9 (1945)

GRADUATE EDUCATION IN PHARMACY ADMINISTRATION

JOSEPH D. McEVILLA

Graduate education in pharmacy administration is perhaps the most unique of all the graduate programs currently being offered by the various schools and colleges of pharmacy. It is a blending of two very old and noble professions. Pharmacy, a highly respected segment of the health professions, is blended with business administration, an equally respected segment of the professions. From the scope of pharmacy we take the practice area—retail pharmacy, the distribution area—wholesaling, and the manufacturing area—the industry. These are blended with the fields of economics, marketing and advertising, and law from business administration. Together they compose the area of pharmacy administration as we know it today. While we must develop a high degree of scholarship in the administration areas, it must be done with full cognizance of the responsibility of the practice of pharmacy as a part of the health professions.

In approaching this area of graduate education, two rather broad problems immediately present themselves. First, what is desired of the individual in the way of undergraduate preparation? Second, what direction should be taken in the development of the candidate in the master's program and the doctoral program? This latter question contains many additional questions which will be posed later in this paper.

Returning now to the question of undergraduate preparation in pharmacy administration, what is essential for the student to have and what is desirable are the main considerations. The prospective graduate student in pharmacy administration should have a background in economics, accounting, marketing, and store operation (management). This sequence of courses is usually offered by the schools and colleges of pharmacy which have an organized department of pharmacy administration. Economics is the most essential foundational course in this area. This course should be the usual one year course offered by economics departments in liberal arts colleges. Such courses as "economics for pharmacy students" or "survey of the social sciences" are not adequate foundation for the student who desires to enter pharmacy administration at the graduate level. The course in accounting should give the student an appreciation for an understanding of the formal accounting statements. He should be able to interpret these statements and have a knowledge of the accounts from which they are prepared. The marketing course should present the various marketing functions, channels, and institutions involved in the distribution of drugs and pharmaceuticals. The course in management should give the student the basic principles of the organization and operation of a retail pharmacy.

A desirable factor is a well-developed state of maturity. Pharmacy administration is primarily concerned with developing individuals who can make administrative decisions based upon facts, analysis, and maturity of thought. For this reason maturity cannot be overlooked in the student who applies for acceptance to the graduate program in pharmacy administration.

Until now, this paper has attempted to outline the preparation needed by the student who desires to pursue advanced education in the specialty of pharmacy administration. The remaining part of the paper deals with the qualitative and in most cases highly debatable issues of graduate programs in pharmacy administration. I shall pose several questions and shall call freely on our Pittsburgh experience only because it is the one with which I am most familiar, and, because graduate education is involved in controversial problems, it is a practical way of pointing up issues which require discussion. I shall not attempt to dictate answers. Such answers as are supplied are only for a point of departure in the over-all discussion necessary for the advancement of all graduate education.

The first question, one that seems basic to any program in this area, is: To what extent should the graduate program in pharmacy administration be oriented toward the classical concept and to what extent toward the professional concept? One of the most perplexing and interesting issues raised about graduate education in pharmacy administration is whether teachers of pharmacy administration courses should have a distinctly professional orientation. There is at present a wide variety of aims and practices in pharmacy administration programs. There is no really accurate way to describe the various viewpoints. I have chosen the words "classical" and "professional" merely as a means of differentiation. Needless to say these two points of view are not clear cut. There are no strictly classical programs, nor are there any strictly professional programs. The frame of reference is an aid in discussing the various requirements of examinations, course work, and research which become the important issues in any discussion of graduate education.

Pharmacy schools, both undergraduate and graduate, are in varying degrees separated from other schools and departments within the university. This tends to illustrate the difference in emphasis referred to above. A simplified summary of the two major points of view may clarify the following discussion of issues.

Pharmacy administration programs which are dominated by the classical concept of the Ph.D. usually require degree candidates to pass examinations in at least two foreign languages, notably French and German, a traditional requisite of most graduate schools of arts and sciences. Examinations, whether they be oral or written, are apt to be in the classical fields of economic theory and/or economic history in addition to those in the specialty. In these programs the candidate is expected to deal with the abstract and theoretical ideas whether or not he is able to show relevance to practical business problems. The theses coming from such programs are usually of general significance and may be quite removed from business problems of pharmacy.

Programs which emphasize the professional concept are devoted almost exclusively to developing an administrative viewpoint in perceiving problems in a concrete business atmosphere. The foreign language requirement is either questioned or eliminated. Courses, examinations, and thesis problems are seldom on the more traditional areas of economics or marketing. They are more often focused on factual knowledge of existing business practice and the analysis of factors centering around administrative decisions

To many, the classical concept of doctoral study appears needlessly time consuming and to some extent unrealistic in a business setting such as pharmacy administration. The strict professional approach may seem to stress very narrow techniques which may produce a constricted mind and become obsolete in a relatively short space of time. Either emphasis in an extreme case has defects, each has a high degree of consistency prescribed by a predominate academic-traditional or professional point of view. A blending of the two points of view seems to be a more desirable program than either one alone. Is it not possible to have a scholarly study of professional business problems in pharmacy? Is it not possible to have scholarly research into actual practices of the entire pharmaceutical industry consisting of retailing, wholesaling, and manufacturing? Could not such research be of a penetrating, exact nature producing results which may have immediate application and still not debase the standards of the doctorate? I feel such research is not only possible and realistic but that such is the case in some of the universities offering graduate programs in pharmacy administration.

The second question concerns the relationship of the master's program to the doctorate. This question contains within itself many additional questions. Should the master's degree be a prerequisite for admission to the doctoral program? Should the orientation of the M.S., M.A., or M.Ph.A. be different from that of the Ph.D.? Should a master's thesis be required of the student who will continue for the doctorate? Should the prospective doctoral candidate currently in a master's program take the same courses, examinations, and do research in the same area as terminal master's candidates?

Many schools have diverse opinions on these particular points; however, most schools feel that the doctoral program should require a higher degree of competence in research and specialization than that required of the master's program.

This whole question is raised in an effort to determine the best utilization of the candidate's time. The blending of the two programs or a dropping of the master's requirement might enable the doctoral candidate to shorten his period of study. At Pittsburgh we have based the doctoral program upon the master's. The orientation of the master's program has tended to be professional in nature. Course work includes some traditional economic theory but is dominated by professional pharmacy administration courses directed toward the analysis of administrative decision, retailing, and marketing decisions. The thesis required of a master's candidate differs from that of the doctoral candidate. The master's thesis should demonstrate the student's ability to assemble facts, analyze such facts, and reach an administrative decision. It may, though not necessarily, have more practical or immediate benefit than the doctoral thesis.

This approach is not without its problems. The professional orientation of the master's program may discourage some prospective teachers who feel the professional—often erroneously called nonintellectual—approach is uninteresting and lacks the stimulus for intellectual curiosity they desire. We have tried to avoid this at Pittsburgh by approaching the professional courses in a scholarly manner which is conducive to the development and stimulation of the individual's curiosity. Without this scholarly approach,

we would not be allowing for the prospective teacher at the master's level and then find ourselves searching in vain for him at the doctoral level. As was previously stated the doctoral program is built upon the master's program; however, the master's program is oriented toward developing the administrator, whereas the doctoral program is directed toward the developing of the researchers and teachers in the specialty of pharmacy administration. While the doctoral program should be admixed with professional concepts, the main orientation should be of a classical nature. It should stress principles of high academic and scholarly ability. The requirements for the doctoral degree should be such as to satisfy the basic requirements of a major discipline plus the necessary requirements directly related to pharmacy administration.

A third question of importance to graduate education in pharmacy administration is: Should foreign languages be required for the doctoral degree? The questioning of this traditional and time-honored requirement for doctoral candidates is directly connected with many issues involved in the appraisal of all doctoral programs; the length of time necessary to acquire the degree in relation to that required for professional degrees, the subject requirements, the orientation of the program, and the emphasis on field or library research.

The language requirement has justification only as a tool for advanced research. While the liberal cultural value of a knowledge of foreign literature is recognized, it has been considered only of secondary advantage. The main thing then is whether foreign languages actually have any relevance or usefulness in pharmacy administration research or are they outmoded prescriptions designed for an academic condition of past years. The foreign language requirement should be re-examined. It should be limited to the doctoral candidate, and then only languages which will be of use in the candidate's specialty should be required. This requirement should not be used as a screening device. Where they are required, a degree of proficiency which will enable the candidate to read the literature of the foreign country should be attained. Where the specialty is such that there is no significant literature in a foreign language, no purpose can be served by its use other than a device to take up time or contribute to the coffers of the language department.

The fourth question is: What is the purpose of, and what should be required in, oral and written examinations?

Most graduate programs in universities have a generally accepted pattern of formal requirements and examinations. However, not all schools are in agreement as to what the requirements are designed to prove or what the student should be examined on. There are a number of schools which feel the candidate should be examined orally upon his depth of knowledge, his philosophy of research, and the relationship of his specialty to the entire concept of living. The written examination should be designed to prove mastery of the field of specialization. This mastery may be shown by examining the candidate's factual knowledge of his field, his sophistication in the bibliography of his field, and his ability to relate and synthesize knowledge. The written examination may also be designed to determine the potentialities of the candidate as a research-teaching person.

The main point which should be brought out is that the examinations, regardless of their objectives, should be a learning experience for the candidate. In too many cases the series of examinations, oral or written, take the form of "hurdles" which are for anyone to take and pass if he can, regardless of the care taken in the admission procedure to the program. Examinations—a certification of some degree of competence—are at least a very complex part of the educational process. They may be designed to test different things at different times. They may be designed to test different things in different candidates. Examinations should in all cases require the candidate to take a fresh look at his topic. This should be the learning experience which enables him to emerge from the circumscribed area of his research to the broad, firm ground on which he will later teach.

The final examination on the thesis opens up another point of divided opinion. Should the examination be confined to the thesis? Should the final examinations force the candidate to defend the logic of his research as well as the techniques involved? Should the candidate be required to relate the possible implications of his research to the larger field of which it is a part? There are many who feel the final examination should be exhaustive in the larger area of which the thesis is a part. Some even question the logic of a final thesis examination. They have grave doubts concerning the purpose, or if there is a purpose, to be accomplished by such an examination.

I believe the final oral examination should enable the candidate to demonstrate the contribution of his research to the general area of his specialization. He should be able to defend the logic of his approach to the problem, the techniques employed in its solution, and the synthesis of the conclusions. The final oral examination should be one of the most significant learning processes of his graduate education. Above all else the final examination should not be a mere formality, a form of rubber stamp, required by regulations.

The last question I would like to raise is: What is the dissertation requirement designed to accomplish and how should a thesis problem be selected?

In general, most directors of graduate education will agree, the dissertation is the principal means for the faculty to judge the candidate's ability to conduct independent research, collect and analyze facts, synthesize conclusions, and push back the frontier of knowledge in his field of specialization. This would indicate that the dissertation requirement has a rather well-defined purpose. It is the "best evidence" provided by the candidate to show his capability to perform research and embark upon a career of acquiring and disseminating both new and existing knowledge.

While there is considerable agreement on the importance and purpose of the dissertation, there is not the same consensus regarding the suitability of topics for doctoral theses. Should it treat large theoretical questions, or should it deliberate upon an administrative point of view in attacking business problems requiring managerial decisions? Should the subject matter be within the narrow field of pharmaceutical retailing, the specialized field of economics or business economics as they may be related to the

broad area of pharmacy administration, or should it reflect an administrative problem requiring the utilization of several of the social sciences for a solution?

In pharmacy administration, as in almost all of the pharmaceutical sciences, we are faced with the problem of deciding whether the thesis should be of immediate practical value or does its practicality immediately screen it out of the high ideal of pure research? Should the candidate base his selection of a problem upon the possible use it may have in present-day business? Are we to be placed in the position of having the prestige of pharmacy administration research at the doctoral level judged by the inverse ratio to its practical application? To a large extent these questions seem to border on the ridiculous, yet they are the basis upon which research, not only in pharmacy administration but in many areas of graduate education, is often judged. In many cases research problems are selected for the student on the basis of their ability to attract funds from industry.

I do not believe any of the above should be the criteria upon which doctoral problems are selected. I do believe problems can be selected which may have a theoretical base applied to a practical problem; a scholarly approach to a concrete business problem requiring administrative decision; a practical problem related to a theoretical concept; or a penetrating study of a single legalistic or administrative point of view which may have or has had an effect on the body-pharmacy. The practical value, immediate usefulness, or abstract theoretical structure should be secondary, as long as the solution or judicious study of the topic will advance the limits of our present knowledge.

The objectives of graduate education as applied to pharmacy administration were aptly put by the Committee on Graduate Education in Pharmacy Administration under the former chairmanship of Joseph H. Kern. This committee listed in its report three objectives:

1. To offer academic training of a specialized nature at the advanced level.
2. To coordinate the academic training so as to provide an individual the opportunity to satisfy his intellectual desires beyond the specialty.
3. To afford individuals the opportunity to express their creativity in original research in pharmacy administration.

The aims of graduate education in pharmacy administration are to develop scholars, researchers, and teachers who by their own efforts will enlarge the scope of our present knowledge of economics, marketing, and administrative techniques as applied to the whole of pharmacy.

The student who desires admission to the graduate area of pharmacy administration should possess three basic essentials:

1. A thorough knowledge of all the pharmaceutical sciences.
2. A high degree of intellectual curiosity.
3. A mastery of effective English, able to express vision in words which result in action.

Possessing these, the prospective graduate student in this area of specialization will find unlimited opportunity for the development of his (or her) full potential.

HOSPITAL PHARMACY

WARREN E. WEAVER

Hospital pharmacy as a separate graduate discipline has been slow in emerging in the graduate programs offered by schools of pharmacy when considered with the well-established programs in pharmaceutical chemistry, pharmacology, pharmacognosy, and pharmacy. This is due, at least in part, to the relatively few specialized practitioners engaged in this pharmaceutical specialty at the turn of this century and the consequent lack of concern by educators for a now-recognized specialty among pharmaceutical disciplines.

The progress made in hospital pharmacy education has been documented in good fashion by Berman (1), and there is no need to repeat that here. The literature of hospital pharmacy has enjoyed a spectacular growth over the past fifteen or twenty years with the ever-increasing numbers of pharmacists employed in hospitals. Archambault (2) in projecting the needs for hospital pharmacists up to 1970 concluded that 10 per cent (about 400) of the graduates in pharmacy must enter hospital practice each year for the next decade. This is in all probability a conservative estimate, and it might be guessed that the actual need for hospital pharmacists is even greater than 10 per cent because of the concern being shown by the various boards of pharmacy for proper pharmaceutical service in hospitals. Inevitably this will bring even more pharmacists into at least part-time contact with this specialty.

With an increased number of practitioners it has followed that training and education of pharmacists for hospital practice has become a matter of interest and concern to educators and hospital pharmacists alike. As early as 1921, Austin (3) advocated a combined academic and professional course of five years for hospital pharmacists. Austin's reasons in support of advanced education are just as applicable today as then. Briefly, he noted: (1) the training of men in the other health professions compared to the hospital pharmacist, (2) the need for familiarity with the work of the physician, (3) the need for acceptance that can be obtained fully only by parity in educational experience, and (4) the need for educated minds trained through study to observe and think as constructive members of the health professions.

In the early 30's Austin's program was obtained in essence as the basic undergraduate curriculum in pharmacy. However, the complexity of modern medicine and hospitals has increased which in turn has accentuated the need for even more education for hospital pharmacists. No doubt the five year course of instruction in many schools will offer better opportunities for educators to provide for some of the needs of this specialty. It is doubtful, however, that the need for additional education or training will diminish, and in fact it is quite likely that there will be an intensification of that need with advances in modern medicine and hospital practice.

The undergraduate who wishes to pursue a career in hospital pharmacy should endeavor to include in his curriculum the basic elements of instruction

in the chemical and biological sciences. Most schools offer good instruction to all pharmacy majors. However, in those instances where physics and biochemistry may be elective courses, they should be included in the future hospital pharmacist's curriculum. The five year program will offer to graduates throughout the country greater opportunities for specialized elective courses in hospital pharmacy. The Committee on Hospital Pharmacy Education of the AACP in its 1957 report (4) recommended that schools offering professional electives in the five year program include ten credit hours of electives as a minimum exposure in the areas of manufacturing pharmacy, hospital pharmacy management, and hospital pharmacy seminar. No doubt, with more schools offering professional undergraduate electives in areas of special interest to hospital pharmacy, more opportunity will be available for preparation leading to a career as a hospital pharmacist.

Advanced training and educational opportunities are more recent additions to the structure of hospital pharmacy. Initially internship programs were inaugurated at hospitals with the intention of offering on-the-job training in this specialty. Through the efforts of the American Society of Hospital Pharmacists the first minimum standards for internship were advanced in 1948 (5). These have been modified slightly, but they emphasize the importance attached to a relatively uniform program of organized training. Subsequently, the educational needs of hospital pharmacy have been recognized by the fact that about one-third of the nation's schools of pharmacy offer academic programs leading to a master's degree.

There does not seem to be any great unanimity of feeling about the specific nature of graduate education in this field, and in all probability it would not be any more desirable to have a uniform program in this field than any other area of graduate instruction. Basically the need for advanced education is "felt" by hospital pharmacists and educators alike, but unfortunately there is no firm documentation of this impression. Little data on the direction the graduates of these programs have taken in the field are available, and, consequently, no firm conclusions proving the value of advanced education have been advanced.

Nevertheless, excellent arguments can be made, most of which condense to Austin's original observations (3). Advancing these to 1959 and accepting them as valid criteria it might be suggested that advanced academic work in hospital pharmacy include basic science subjects such as biochemistry, pharmacology, physiology, and chemistry with appropriate research in a subject of interest to hospital pharmacy. This course structure presupposes good undergraduate training in the elementary phases of each subject area and solid professional courses in pharmacy. It is evident that if the future hospital pharmacist covered these subjects to the extent needed to gain equal competence with the physician and excellence in drug therapy, he may well have earned enough course credits for a Ph.D. In most respects the hospital pharmacist would need this training to meet today the criteria originally set up by Austin. It is most doubtful that present graduates of four and five year programs would do so even with a year of internship.

Hospital pharmacists with advanced degrees should have open to them careers in teaching hospitals and in unique programs involving pharmaceutical skills that are not available to untrained undergraduates. Whether this

is realized depends in part on the philosophy of educators. If graduate programs leading to a master's degree are considered terminal programs, they will be just that! Rather the master's degree should be an intermediate step to further educational opportunity.

Some evidence of the terminal concept may be present in Francke's proposal for a school of hospital pharmacy (6). Here is reflected the feeling for "hospital pharmacy oriented" education in pharmacy involving six college years and leading to the degree of doctor of pharmacy. Such a step is unusual in that it represents an initial step in specialization in a subspecialty of a science field. In some respects this would be like having separate schools for electrical engineering and mechanical engineering or organic chemistry and inorganic chemistry. These comparisons presuppose that most of us are willing to recognize pharmacy as a composite discipline built upon basic science subjects.

Needless to say, a six year course leading to a professional doctorate will offer titular equality, but it is highly questionable whether the real need of hospital pharmacy can be met by any other course of action than graduate study of more conventional nature. Since the great majority of hospital pharmacists have had no academic graduate education, we can again observe that our opinions are speculative. However, they are based fundamentally on true equality of the hospital pharmacist in his working relationship with the physician. It would appear that large hospitals and certainly teaching hospitals must have men who have received advanced instruction and training in basic science areas if the hospital pharmacist is to enjoy honest equality.

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If a man earns his livelihood practicing a profession, he maintains his interest in it; he gives thought to its problems; he feels encouraged to keep abreast of the development in his chosen calling; he continues his professional growth.

Simon E. Sobeloff, Am. J. Pharm. Ed., 8, 312 (1944)

ACADEMIC PREPARATION FOR GRADUATE STUDY IN THE FIVE YEAR PROFESSIONAL PHARMACY CURRICULUM

GLENN L. JENKINS AND JOHN E. CHRISTIAN

One of the long-range problems in graduate education in the pharmaceutical sciences which should be receiving careful consideration by the various schools and staffs is the possible effect of the five year undergraduate pharmacy program on graduate student quality and enrollment in the years ahead. The large majority of our schools have neglected to consider the possible effects of the extended undergraduate curriculum on the graduate program. In the usual instance, the schools are adding the fifth year onto the four year undergraduate curriculum without encouraging or providing means for the superior student to prepare himself adequately for graduate work. These programs likewise do nothing, in general, to discover qualified and possibly interested students and encourage them to consider graduate endeavor. It is reasonably obvious that the superior and scientifically minded student is not sufficiently challenged nor stimulated in courses geared for the median student and taught at lesser scientific levels for a full five years. In addition, because of the extra year required for the pharmaceutical sciences over other basic science graduate programs, many of the top scientifically minded students will elect to take degrees in other disciplines in which the degrees can be obtained in a shorter period. It should also be pointed out that the one year and two year preprofessional years provide time during which other disciplines can attract the superior student who is interested in advanced training. Experience with preprofessional years has already indicated that this does occur, and especially so with superior students. This all seems to add up to the possibility of a relatively smaller number of well-qualified pharmacy graduates interested in continuing into graduate education in the pharmaceutical sciences at a time when larger numbers of superior research personnel are needed for the five year teaching programs and for expanding industry.

The extent of these problems of graduate education in connection with the extended undergraduate program in pharmacy is difficult to evaluate at this time; however, the schools should be constantly considering ways and means of discovering qualified students and encouraging them to enter into graduate studies in the pharmaceutical sciences by whatever means possible and still be consistent with a sound five year professional undergraduate program.

Most educators agree that the superior student can and should be motivated to accomplish an educational level consistent with his ability. This most certainly cannot be done by placing these students in courses taught at the median and below median level, and especially so for a full five years. One answer to the problem is the establishment of a "scientific option" or similar system in the professional pharmacy degree program to provide for teaching at different levels depending on student ability and interest. This type of program should permit the interested undergraduate student to

prepare himself more adequately for graduate study and should result in superior students becoming interested in continuing their studies into graduate education.

In establishing the minimum five year professional pharmacy program at Purdue University, which will be initiated in September, 1960, careful consideration has been given to the possible effect of the extended curriculum on the graduate education program. The Purdue curriculum based on one year of prepharmacy and four years of professional study (1-4) provides for:

(1) The selection of an *optional* curriculum after the completion of one year of prepharmacy and two years of professional study, namely a *"professional option"* in preparation for general practice or a *"scientific option"* in preparation for industry, research, and teaching.

(2) The satisfactory completion of not less than 160 credit hours for the degree of Bachelor of Science in Pharmacy.

(3) The permissive utilization of not to exceed eighteen credit hours toward the M.S. degree for work taken in the fifth year by students who meet the requirements of the Graduate School of the University.

(4) A minimum of six credits of electives in the third year, six credits in the fourth year, and twenty-one credits in the senior year. It is intended that these electives shall provide approximately fifteen credit hours of professional and scientific education and fifteen credit hours of general education.

(5) Each student's program is to be held within the range sixteen to eighteen credit hours per semester, except in unusual cases, and thus upgrade the student performance per credit hour, improve the utilization of facilities, and increase the efficiency of the faculty.

The complete five year curriculum is given in Table I.

Certain minimal requirements for the optional programs have been established. In the "professional option" merchandising, marketing, and not less than eight credit hours in undergraduate-graduate school courses (500-599 series) in pharmacy, pharmacognosy, pharmaceutical chemistry, pharmacology, or pharmacy administration must be elected. In the "scientific option" a minimum of fifteen credit hours shall be selected from beginning graduate student courses in chemistry, biology, pharmacy, pharmacognosy, pharmaceutical chemistry, pharmacology, or pharmacy administration. Students from either option may elect additional subjects from a broad spectrum of areas outside the pharmacy school to complete a normal load of not less than sixteen credit hours per semester. The program of each student must have the approval of an appointed counselor. Thus it will be noted that this curriculum provides for a minimum of thirty-three hours of electives. This flexibility permits the superior student with the approval by his counselor to initiate more advanced courses as early as his third year which will prepare him for entering into a graduate program. This provision for selection of a preferred option early in the undergraduate program should motivate superior students who might not otherwise consider the possibility to continue into graduate work.

In addition, this curriculum plan permits those students who are capable, who declare their intention to use certain graduate-level courses during

TABLE I. THE FIVE YEAR CURRICULUM AT PURDUE UNIVERSITY SCHOOL OF PHARMACY

1st Year		2nd Year	
(4) General Chemistry	(4) General Chemistry with Qualitative Analysis	(4) Plant Science	(4) Zoology
(3) Algebra	(3) Trigonometry	(4) Organic Chemistry	(4) Organic Chemistry
(3) English Composition	(3) Speech	(4) Physics	(4) Physics
(3) Sociology	(3) Psychology	(3) Government	(3) Economics
(2) Military Training or Physical Education	(2) Military Training or Physical Education	(2) Military Training or Physical Education	(2) Military Training or Physical Education
(⅔) Developmental Reading			
(1) Pharmacy Orientation	(1) Reading Comprehension		
16⅔	16	17	17
3rd Year		**4th Year**	
(3) General Pharmacy	(3) General Pharmacy	(3) Physiology	(3) Physiology
(4) Quantitative Analysis	(4) Bacteriology	(3) Organic Medicinal Products	(3) Pharmacy Admin.
(3) Applied Pharmacognosy	(3) English Composition	(4) Pharmacy Admin.	(3) Applied Pharmacognosy
(3) Economics	(3) Physiological Chemistry	(4) Prescription Practice or Manufacturing	(4) Prescription Practice or Manufacturing
(3) Electives	(3) Electives	(3) Electives	(3) Electives
16	16	16	16
	5th Year		
	(3) General Pharmacology	(3) Applied Pharmacology	
	(3) Dispensing or Pharmacy Elective	(3) Dispensing or Pharmacy Elective	
	(1) Pharmaceutical Calculations	(1) Pharmacy Survey	
	(9) Electives	(9) Electives	
	16	16	

the fifth year for graduate credit, who select a major professor, and who meet the standards of the Purdue University Graduate School as shown by the approval of a "plan of study" to use not to exceed eighteen credit hours of graduate courses toward an advanced degree. Such students are limited to a maximum load of eighteen credit hours during the semesters when credit is counted for graduate credit as provided for in the regulations of the graduate school.

The basic change in policy involved in this program is that certain credits taken under specified conditions will be counted toward the bachelor as well as an advanced degree. This practice is not uncommon in the areas with an extended program of undergraduate and professional instruction. In reality the change is based on a technicality, since many graduate schools (Purdue included) permit qualified students who exceed the four year undergraduate credit hours of instruction (142 credit hours is the present requirement for the bachelor's degree) to take certain graduate-level courses for graduate credit.

It is believed by the faculty at Purdue that this program will upgrade the graduate program in the school of pharmacy by specifically selecting in advance those qualified students who have shown the ability to pursue studies, which in turn will permit early indoctrination into the fundamentals of the scientific approach. An added advantage should also be an early motivation on the part of the superior student to permit him to progress at a pace consistent with his abilities and thus permit maximum benefit per unit time spent in the five year curriculum.

After a phase of violent warfare there is a narrow band of time in which men raise their heads and look to the hills for help before lowering themselves again into the arena and turning to a war of trade and credit: in this short time they do a little good, let loose a larger idea into the world to grow as it can, and then turn their backs upon it. This is not much, but it is something.

Curtis Bok, Am. J. Pharm. Ed., 7, 289 (1943)

ARTICLES

AN EDUCATOR'S EXTRACURRICULAR OBLIGATIONS INVOLVING STANDARD TESTS*

RICHARD A. DENO

The extent to which the pharmacy teacher is called upon to fulfill extracurricular obligations is an important factor in determining the degree to which he is free to develop his courses and to supervise and conduct research. We all recognize, in a measure at least, the value of recruitment activities, sponsorship of student organizations, development of in-service programs, and service on college and university committees. We also recognize the inroads such demands make on time available for our primary obligations.

I do not intend to argue here the relative merits of the extracurricular versus the curricular. The terms originated from the Latin for race course; their aptness today requires no further elaboration. Nor will I attempt to discuss the many extracurricular obligations that may confront the pharmacy teacher. Three such obligations, however, have fallen to my lot in recent years: admissions, scholarships, and counselling. All are educationally important for the student; and the teacher, it seems to me, is qualified by background and interests to contribute appreciably to the solution of problems in each of these areas.

At one time I resented having to devote appreciable time to the details of admission policies. I now believe they must be set by the teachers rather than by specialized administrative officers. During the past two years I have spent considerable time screening scholarship applications. Experience in this work has convinced me that a background in teaching is essential for an acceptable evaluation of such materials. Counselling of pharmacy students, I believe, is best done by pharmacy teachers, with help in exceptional instances from psychological and psychiatric experts. The relatively few students who have taken the formal courses at Michigan intended to help prepare them for academic careers have been fully as interested in suggestions on extracurricular activities such as these as on academic matters such as the preparation of syllabi and methods of instruction.

Admission policies are currently being re-evaluated throughout the country. Marked increase in recent years in the numbers of undergraduate scholarships available has led to the development of a new philosophy and rather detailed procedures for evaluation of scholarship applications. Counselling of pharmacy undergraduates is being undertaken systematically in more and more colleges, following increased attention to counselling services for all college students throughout the country.

Admissions, scholarships, and counselling also relate in some measure to aptitude and achievement testing. In view of the current critical attention to these three aspects of extracurricular matters and their relations to testing programs, a brief discussion of the three may be timely, preceded by a review of the most widely used national tests of aptitude and achievement.

* This article was written at the invitation of the Editor.

TESTING PROGRAM

About sixty free-lance tests designed to predict likelihood of success in college have been developed in this country and used to a greater or lesser extent in more than one school system or institution of higher learning. Few of these tests have achieved country-wide acceptance. Some of them, however, are used nationally to an extent that scores frequently appear on records of students applying for admission to pharmacy or students seeking pharmacy scholarships. Included in this group are tests of the College Entrance Examination Board (CEEB), now administered for the College Board by the Educational Testing Service through the cooperation of secondary schools throughout the country.

For many years the best-known test of the College Board has been its Scholastic Aptitude Test (SAT), a three-hour test, now costing $7.00, and administered throughout the country from one to six times per year depending upon the number of applicants in different centers. About one-third of the students taking the SAT are juniors in high school, about two-thirds are seniors. Over the years the SAT of the CB has come to be accepted as perhaps the best measure available of likelihood of success in college. Two scores are reported on verbal and on mathematical proficiencies both purporting to measure reasoning ability rather than remembered facts. Scores on the SAT range from 200 to 800, about two-thirds being between 400 and 600. Scores considered to presage likelihood of success in college vary from college to college, and an inflexible minimum cannot be established for a single college or for a single field, such as pharmacy. The composite freshman class at 129 colleges during a recent year, however, showed a majority with more than 500 for both verbal and mathematical scores.

A second type of test of the CB consists of achievement tests, usually taken in one, two, or three of thirteen subjects. Each test takes one hour, and the results are of value in supplementing the data furnished by the SAT test. The same scale, 200-800, is used for reporting achievement as is used for the SAT test.

In 1956 the CB introduced a third test, the Scholarship Qualifying Test (SQT), a two-hour test costing $1.00 and designed to aid in the selection of candidates for national, state, and local scholarships. The CB SQT was given in the fall only and was abandoned in the spring of 1959, being replaced by a new CB test, the Preliminary Scholastic Aptitude Test (Pre SAT).

The Pre SAT will be given in October to juniors in high schools throughout the country, and will cost $1.00 (versus $7.00 for the CB SAT previously taken by many juniors and now, presumably, intended mainly for seniors). The Pre SAT will be a two-hour test yielding verbal and mathematical scores on a scale ranging from 20 to 80. This makes direct comparison with the scores of 200 to 800 of the SAT possible. The Pre SAT has the advantages of low cost and administration to juniors, making it of value for counselling of upperclassmen in high schools and for scholarship purposes in college programs.

In considering the record of a high school student applying for admission to pharmacy or for scholarship aid, or in checking his record for background

information at the time of counselling, data from the SAT (and, in the future, from the Pre SAT), supplemented by IQ score, are significant items. Such data are perhaps more commonly available in eastern states than in the West, but they are found on records throughout the country.

In 1955 a new national scholarship agency appeared, the National Merit Scholarship Corporation (NMSC), financed by the Ford Foundation and the Carnegie Corporation. NMSC contracted with Science Research Associates of Chicago for the preparation of tests designed for screening applicants for Merit Scholarships. These tests are designated the National Merit Scholarship Qualifying Tests (NMSQT). In 1958-1959 nearly one-half million students comprising about one-third of all high school seniors took the NMSQT. The test costs $1.00, requires three hours for completion, and provides five subscores and three composite scores, each ranging from seven to thirty-six (but with results also reported as percentiles for all those taking the NMSQT).

Comparison of NMSQT scores with SAT scores of the CB is somewhat risky, in part because students taking the last-named test are certainly a more highly selected group. Eventually comparisons between the NMSQT scores and Pre SAT may prove to be more helpful. Scores in the early twenties on the NMSQT appear to be roughly comparable to scores in the neighborhood of 500 on the SAT.

Still another set of scores will probably soon appear on the high school records of students admitted to the study of pharmacy, especially in the Midwest and surrounding states. A new national program in testing is currently being developed at the State University of Iowa and is known as the American College Testing (ACT) program. Proposed is a three-hour battery of four tests, the total score of which will "provide a comprehensive and analytical description of the students' general scholastic ability." Although the tests will be administered to high school students, the program is college-oriented in that colleges register for the service and the tests will be administered chiefly on college campuses, the first planned for the fall of 1959. Costs will be borne by the students being tested, at the rate of $3.00 for the battery of tests.

A fairly common pattern of tests that appears to be developing for many high school students is:

junior year:
fall: Pre SAT ($1.00)
spring: NMSQT ($1.00)
senior year
fall: SAT ($7.00), or ACT ($3.00)
CB achievement tests for some

ADMISSIONS

To return to pharmacy teachers, the extremes of their concern with admissions problems range from absolutely none to detailed consideration of each applicant and final decision in committee on admission or rejection. Teachers having nothing to do with admissions are those in universities where the admission of pharmacy students has been relegated entirely or almost entirely to admissions officers, or where participation in admissions matters by pharmacy is handled entirely by the dean of pharmacy. At the

other extreme are those relatively few colleges of pharmacy which handle all of their own admissions through college committees.

In many cases concern of the pharmacy teacher with admissions lies somewhere between these extremes. He may serve on an admissions committee which advises university or college officials who handle the details of admissions. In some few instances he may be involved in these details himself. In either event, he needs to evaluate the scores of such tests as have been described previously, as well as those of one or more of the free-lance tests that may be commonly used in his locality. (Iowa, for example, has its own College Scholarship and Placement Testing Program, to be replaced next year by the ACT program. Minnesota likewise has a state program in operation, probably to be continued and not to be replaced by the ACT program despite the fact that Minnesota is in the geographic area ACT is intended to serve.)

Scores on one or more tests are, of course, only one factor to be considered in the admission of a student to pharmacy. They are, however, one of the more significant of the several factors to be taken into consideration. When results from more than one test are available (as seems likely for many students in the future), including an IQ score, relative agreement among the scores is a potent factor in reaching a logical decision on admission. It is probably not advisable to fix a rigid limit below which no student will be admitted. However, the experience of many colleges, in some instances over many years, gives data upon which a rule of thumb can be formulated. Such a rule is helpful to those of us in pharmacy, ordinarily not well versed in the intricacies of testing and interpretation.

Scores of 500 or better on both verbal and mathematical parts of the SAT presage at least satisfactory work in pharmacy. On the verbal part, 500 corresponds approximately to 24 on the word usage test of NMSQT. In mathematics, 500 is comparable to 21 on the mathematics usage test of NMSQT. A composite score of 1,000 on the SAT is believed to be roughly equivalent to 22 on the total composite of NMSQT. These scores usually indicate an IQ between 115 and 120.

Scores of 450 to 500 (composite of 900 to 1,000) on SAT and a total composite below 22 on NMSQT indicate borderline cases as far as likelihood of success in a high-level program of pharmacy study is concerned. Scores below 450 on SAT or around 20 on NMSQT total composite correspond to an IQ of 110 or below, and such students should not be encouraged to enter the study of pharmacy under ordinary circumstances.

The value of these data in determining admissions to colleges of pharmacy after 1960 will be decreased somewhat because a majority of the colleges will rely on collegiate records of prepharmacy study. It is not unlikely, however, that some colleges of pharmacy will continue to admit students directly from high school, into a 0-5 program. It is also not unlikely that many students will apply for admission to pharmacy from borderline junior and other colleges whose standards cannot be equated with those of stronger colleges and universities. In each of these cases admissions to pharmacy should depend in part upon the earlier records as shown in one or more test scores. The test scores will continue to be of value in the awarding of scholarships, becoming available to undergraduates (including pharmacy) in increasing numbers.

SCHOLARSHIPS

The term "scholarship" is ordinarily now applied to grants-in-aid made to able and needy students. Historically, scholarships were monetary prizes bestowed on students who had demonstrated outstanding ability in a particular field. A few of the scholarships awarded in colleges of pharmacy retain this prize feature, but a larger number conform to the current usage of the term. Provision of undergraduate scholarships has increased tremendously since World War II. This fact notwithstanding, only about 5 per cent of the income of the nation's college students comes from scholarships. A large majority of college students receives no scholarship aid, since those who are awarded scholarships ordinarily receive a sum covering much more than 5 per cent of their collegiate expenses.

Scholarships are ofttimes of vital significance to those receiving them, spelling the difference between attending college or not. They also carry a measure of prestige, and this factor tends to embitter nonreceivers who have demonstrated unusual ability but cannot prove financial need. In many cases a scholarship carrying only a token financial award is granted in such cases, bestowing the prestige but conserving most of the limited funds for more needy, as well as able, students. While up-to-date data on scholarships in pharmacy are not available, there is reason to believe that pharmacy students participate in such awards to the degree holding for the nation as a whole. Few pharmacy students receive the relatively generous awards provided by such industrial concerns as General Motors, but national and local pharmacy scholarships are available each year, and pharmacy students appear to hold their own in the competition for the many state and university scholarships available throughout the country.

Apart from many highly specialized scholarships, most of those available in the United States are provided by (1) industry, (2) the federal government, (3) educational foundations, and (4) colleges and universities, frequently from funds appropriated by the state. (1) No large-scale individual industrial program for pharmacy comparable to that of General Motors, General Electric, or IBM, for example, is available. A number of scholarships of the prize type, financed by various firms, are awarded each year to pharmacy students, however, and the pharmaceutical industry contributes a major share of the funds of the AFPE, some of which are used each year for undergraduate scholarships.

(2) Scholarships of the federal government go to particular segments of the college population, including certain students of pharmacy. The "GI Bill," no longer available to most college students, has helped hundreds in pharmacy and in some instances is still being used. The War Orphans Educational Assistance Act provides help for far fewer numbers, and the recently enacted National Defense Education Act, while not providing undergraduate scholarships, has greatly strengthened loan plans in operation on many campuses having colleges of pharmacy.

(3) The American Foundation for Pharmaceutical Education provides funds each year available in an amount up to $400 to any class A college of pharmacy on a matching basis, to be used for scholarships for juniors and seniors. During 1957-1958, such scholarships were provided in sixty colleges to 154 students at an average cost to the Foundation of $142 per student. Note that the total funds available are double the amount given

by the Foundation because of matching monies provided by the colleges participating in the program. About $45,000 in scholarship funds were thus provided in 1957-1958. Awards during 1958-59 will slightly exceed those of 1957-58, and plans are being considered to increase the sum available to each college to $600, and possibly to authorize the scholarships in the upper three years of the undergraduate program.

(4) College and university scholarships are provided from income from invested scholarship funds given to the institutions over the years, from alumni annual giving, from state and municipal appropriations, and from other sources. Pharmacy students share in such grants on the same basis as do other undergraduates.

At the present time many undergraduate pharmacy scholarships are awarded rather informally, by the dean or by a college scholarship committee. Pharmacy students competing for university grants, on the other hand, must comply with the procedures standard for the institution administering the funds. In most instances the two major factors considered are scholastic ability and financial need, with lesser emphasis on such items as extracurricular activities and recommendations of teachers, alumni, and others. As pharmacy scholarships become more widely available it may be worthwhile for pharmacy colleges to consider the adoption of methods of selection more closely akin to those now widely used in universities where large numbers of scholarships are awarded.

Judgment of the ability of prospective scholarship holders is made largely on the basis of high school record (grades, position in class, opinion of teachers) and scores achieved on one or more of the many tests previously referred to. Variations in quality of instruction among high schools make grade comparisons difficult, but a record showing more grades of A than B, with few if any of C, is needed to warrant serious consideration for scholarship award where competition is keen. Test scores meriting admission to college do not automatically merit a scholarship; in most instances scores appreciably better than those suggested for admission are needed. Scores in the neighborhood of 600 or better on the verbal and mathematics parts of the SAT, in the high twenties on the NMSQT, and IQ's of 120 or better are often needed to enable students to compete successfully for scholarships.

The matter of establishing financial need as a requisite for a scholarship is subject to widespread debate. Nevertheless, with funds limited and applicants numerous few programs ignore this issue. The College Scholarship Service (CSS) was created in 1954 by the CEEB to serve as a clearing house for duplication and transmittal of confidential statements designed to establish financial need on the part of a scholarship applicant. Parents of students applying for scholarships in institutions using the CSS transmit a copy of a Parents' Confidential Statement (PCS) to the Service. This is duplicated and sent to as many institutions as requested by the parents. Analysis of the PCS by members of a scholarship committee serves to establish the need as defined by the committee in terms of estimated costs at a given institution for tuition, board and room, and essential supplies. Parents are asked to state the sum they feel they can provide annually ("parents' offer"), and standard procedures have been carefully devised to determine the sum the parents may reasonably be expected to provide in the light of their fiscal status ("parents' contribution"). It may be argued

that the relatively small number of scholarships in most colleges of pharmacy does not warrant use of the rather elaborate mechanism and analysis developed by CSS. Adaptation of the CSS philosophy, form, and procedure, however, may be very helpful in a college of pharmacy scholarship program.

COUNSELLING

Counselling of pharmacy students in the various colleges varies greatly in pattern. In some instances there is very little organized counselling; in others the dean serves as counsellor to all pharmacy students; in still others a fairly well-organized system of counselling using members of the faculty has been developed. Regardless of pattern, every teacher serves as counsellor to students in his own classes. The degree to which he participates in this worthwhile and frequently productive extracurricular obligation is largely determined by his interest in the academic and personal problems of students and his willingness to devote valuable time to consideration of their difficulties.

The sort of counselling undertaken by the pharmacy teacher is ordinarily not deeply concerned with detailed profiles obtained from batteries of tests. He can, however, frequently obtain clues helpful in explaining some of the difficulties in which pharmacy students may find themselves from such test results as those given by SAT or NMSQT. Early in his relationship as counsellor to a particular student such results are especially useful in enabling the teacher to form a logical impression of what may be expected subsequently from the student. In evaluating test results in a counselling situation (as for admissions and scholarships) detailed knowledge of aptitude and achievement testing is not required, but a general concept of the nature of the tests and some notion of the meaning of the scores is needed. For each of the tests discussed here data on these matters are obtainable from the sponsoring agencies, and for certain situations rather complete elaborations can be obtained.

SOURCES OF INFORMATION

The following agencies provide literature either free or at moderate cost descriptive of programs administered under their sponsorship.

College Entrance Examination Board, c/o Educational Testing Service, Box 592, Princeton, New Jersey, or Box 27896, Los Angeles 27, California. The College Board publishes a *Bulletin of Information* on its SAT and achievement tests, as well as separate bulletins on other testing programs. Descriptive booklets on the SAT and on the achievement tests are also available, as is a basic manual on the use and interpretation of the various tests sponsored by the CB. Data on these publications, including prices, may be obtained from either the east or west coast office as may a list of other publications of the CEEB.

Among their other publications the *Computation Manual* (latest edition) of the College Scholarship Service is especially useful in outlining current practice on scholarships in many institutions. The *Manual* describes in some detail the computation procedure designed to establish a reasonable expectation of the parents' contribution.

The National Merit Scholarship Corporation, 1480 Sherman Avenue, Evanston, Illinois, will furnish data on the National Merit Scholarship

program and on the NMSQT. An annual *Interpretive Manual* outlines in some detail the NMSQT and includes comparisons between certain of the SQT tests and scores on the verbal and mathematical parts of the SAT of the College Board.

Measurement Research Center, Inc., Iowa City, sponsor of the new American College Testing program, has published an announcement giving details of the project and called *ACT-The American College Testing Program.*

How to Finance a College Education, by W. Bradford Craig of Princeton University, released in May, 1959, by Henry Holt and Company, contains much up-to-date information on admissions and scholarships as well as on other matters that may be involved in the extracurricular obligations of the teacher. Although the book is addressed to prospective students and their families, much of its contents are of interest to the college teacher.

. . . it is unfortunate that pharmacy did not keep in line with medicine when that profession adopted the progressive educational program of 1918 which introduced, among other higher standards, a requirement of general cultural education on the college level as a prerequisite for admittance to an accredited school of medicine.

H. Evert Kendig, Am. J. Pharm. Ed., 9, 192 (1945)

FIELD TRIPS AS A TEACHING AID FOR STUDENTS IN FRESHMAN PHARMACY

C. B. GRANBERG

Various authors have reported in pharmaceutical literature the paucity of information on teaching methods in pharmacy (1, 2). A search of the recent pharmaceutical literature reveals this situation to be especially true in regard to beginning pharmacy courses. This statement may be explained partially by the fact that approximately one-half of the schools of pharmacy do not now offer a course in freshman pharmacy along the lines of the older classical course covering topics such as carbonization, destructive distillation, crystallization, etc. A committee of the Pharmacy Teachers Conference reported at the Detroit meeting in 1956 that thirty-nine of the colleges of pharmacy of the AACP were offering a separate course in principles and processes of pharmacy (3). Blauch and Webster (4) do not suggest such a separate course in their pharmacy curriculum.

In the College of Pharmacy of Drake University, the beginning pharmacy course for freshmen and new students is titled "Fundamental Principles and Practices of Pharmacy," but in actual content the course is primarily orientation and history of pharmacy. The topics previously assigned to this course are now integrated into preparations, physical pharmacy, or dispensing. The pharmacy faculty realized that a new approach in the laboratory of this course was required to harmonize with the current didactic information being offered. After considerable discussion, we decided on a series of field trips to acquaint our new students with the various aspects of pharmacy and areas of endeavor available to them as pharmacy graduates. We realize this venture is not original (5, 6), but we believe few other colleges utilize the program to the extent we do.

The students are divided into three laboratory sections with approximately an equal number of persons per section. The laboratory is scheduled for Monday, Wednesday, and Friday afternoons for two hours. Trips are made by private auto with student and faculty drivers except for one full-day trip which is made by chartered bus.

An attempt has been made to include as many types of pharmaceutical operation as Des Moines and the surrounding area have to offer. Generally, the breakdown of establishments visited is as follows:

1. Retail.
   a. Independent-general.
   b. Agency.
   c. Chain.
   d. Rural.
   e. Prescription shop.
2. Hospital.
   a. Private (church-supported).
   b. Public (county-charity).
   c. Government (Veterans Administration).
3. Manufacturing.
4. Wholesale.

Thirteen trips are made during the semester, so that in some instances more than one visit is made in a category, i.e., two or three independently owned general retail stores are visited.

In the retail category, we select those stores we consider the most successful in the community on the basis of over-all operation. However, to illustrate the other side of the picture, we purposefully choose one store considered to be *not* one of the best examples of modern retail pharmacy. This leads to a rather delicate situation because in an area the size of Des Moines it is easy to be too obvious. Some stores are visited two and three consecutive years while others are changed yearly, the decision being predicated on convenience of either the store owner or the college. We have found the proprietors contacted to be very willing to cooperate in this venture and anxious to have the groups return again the next year.

From the owner or manager of the retail stores visited we try to get general information regarding selection of store site; how the store was obtained; layout; buying; advertising; public services offered; public, professional and interprofessional relations; professional attitude and practice; administrative methods; and other information the host deems pertinent. A free exchange of questions and answers between the students and the proprietor is encouraged. A number of our new students have not had any practical pharmaceutical experience, and some of the questions may seem immaterial or to be prying, but the proprietor makes a sincere effort to provide a complete and fair answer.

The three types of hospitals are visited to illustrate how pharmacies are operated under various administrative situations. We and the students are particularly interested in how medications are handled, priced, and charged to the patient; how narcotics are recorded and dispensed; interprofessional relations; and all other aspects of hospital pharmacy as it differs from retail pharmacy. One of the hospital administrations permits a tour of all departments of the institution including the psychiatric wing, surgery, and morgue. Another provides a complete rundown, with visual aids, on the organization and administrative responsibilities of the hospital, and this is of interest and benefit to the student.

The Des Moines area does not have a large-scale pharmaceutical manufacturing plant. As a substitute, a visit is made to two smaller-scale veterinary medicine manufacturing houses. One of these requires a full-day, 250-mile round trip by chartered bus. The company treats the students to a lavish buffet luncheon and then conducts small group tours through all departments of the company —research, production, packaging, IBM accounting, sales—even the organic chemical production building. This is an interesting and informative trip supplying the students with an insight into the total picture as concerns pharmaceutical production. Each of these companies specializes in a different field of veterinary medicine (one poultry and the other large animals) so there is little duplication and rather complete coverage of all possible pharmaceutical products (liquids, ointments, tablets, biologicals), methods of equipment for their manufacture, standardization, control, and distribution.

The largest drug wholesale house in Des Moines is visited, by design, just prior to Christmas. This gives the students an opportunity to see such an organization at its busiest season, and offers the wholesaler the opportunity to show to the students his complete operation in full swing. The students, in

groups of eight to ten, are conducted through all departments of the wholesale establishment. The show room is naturally attractive to the students, and the wholesaler makes use of the season to give several valuable gifts to students selected by lottery.

The majority of the students exhibits a keen interest in the tours, and is anxious to see, to hear, and to question the various hosts about their particular operation. Not only does the student acquire information about the practice of pharmacy, but he makes valuable contacts he may pursue later in regard to employment. Often individual students return to a store or other establishment visited to gain more detailed information about the operation of that place of business.

We are convinced these trips are of benefit to the new student of pharmacy. They merit his observation at close contact and comparison in retrospect of several of the more popular areas of pharmacy into which he may venture upon graduation. The student who has had no prior professional contact with pharmacy is acquainted with the profession as it is practiced in several ways and may make his own decision as to whether or not this is the vocation he desires to pursue.

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Rational social and sound economic progress in the future will stem from better and broader education. The problems with which this country will be confronted will be solved only by a clearer vision of the interrelation of life's component parts and this can be brought about only by increased knowledge and its scientific application or utilization.

H. Evert Kendig, Am. J. Pharm. Ed., 9, 192 (1945)

POSTDOCTORAL STUDY OF CHEMISTRY IN SWITZERLAND*

CHARLES F. MARTIN

INTRODUCTION

During the 1957-58 university year, it was my good fortune to be relieved of campus responsibilities in order that this time might be spent living and working among laymen and scientists in an environment far removed from that which had been most familiar to me for many years. Being, for a time, a resident of a foreign land was in itself an exciting adventure; but more than that, in a purely selfish vein, the objective of this program was realized in many interesting and rewarding ways.

Permit me to preface my remarks by calling your attention to separate papers which have appeared recently in the *American Journal of Pharmaceutical Education* by Drs. J. H. Burckhalter (1) and Glenn Sonnedecker (2). Both of these publications outline in some detail the system of education, the status of the faculty both within and without the university, and the faculty-student relationships which are characteristic of university life in the Federal Republic of Germany. Not at all surprising is the fact that university life in the German-speaking areas of Switzerland is much the same, when one recalls that a German people, the Alemanni, settled much of the northern and eastern sections of this country following the fall of the Roman Empire. Through the ages, the culture and language of these people have influenced the growth and development of civilization in this part of the world. Higher education, which had its beginning with the founding of the first Swiss university at Basle in 1460, is no exception. Allow me, then, to forego a presentation of factual information which would be repetitious, and to confine my discussion to reflections on a year spent as a postdoctoral student in organic chemistry at the Chemical Institute of the University of Zürich.

THE UNIVERSITY

For the greater part of the year, I was privileged to spend my time in the laboratory pursuing a research program under the supervision of Professor P. Karrer. There were seven other of Professor Karrer's collaborators occupying the same laboratory in which I was assigned space: two postdoctoral students, and five doctoral candidates. This climate, in addition to providing me with the obvious advantages to be gained by working with an eminent scholar, created an atmosphere wherein, as an active participant in its program, an acquaintanceship with the university system was possible. And by no means the least of my privileges was the chance I had on numerous occasions to visit with the Swiss and German students, and other members of the faculty at the Institute. Because, then, of this rather restricted frame of reference, it is not possible for me to make broad statements concerning postdoctoral study in all of Switzerland. But, if the University of Zürich, and its Chemical Institute are typical of insti-

* This article was written at the invitation of the Editor.

tutions of higher education in this country, and I have no reason to doubt that they are, then there are some observations I have to make which it is hoped may be of interest.

The modern city of Zürich, which is not only the home of its canton-supported University, but also of the federally-supported *Technische Hochschule,* is marked by the practicality and spirit of hard work which characterizes the German civilization. This spirit, with overtones of austerity and scrupulousness, contributes in great measure to the charm of the city, and, as would be expected, is reflected in the educational system. The University of Zürich this year celebrated its one hundred twenty-fifth anniversary, although its true origin is said to extend back four centuries to the time of Zwingli. Even with this impressive background, it was not my feeling that this necessarily influenced the attitudes of personnel at the Institute in their relationships with students and guests from other countries. As a matter of fact, there were occasions in which it seemed that these relationships were surprisingly informal. An expression of this may be evident, furthermore, in a discussion I had at one time with a doctoral candidate, who proudly pointed out the interest and satisfaction taken by the director of his research in the suggestions that he had made concerning the development of the investigation. It was evident from this conversation that although the student was exploring only one part of an extensive research program, he had been kept informed of the progress being made by other students working on related parts of the investigation and that he knew quite well the over-all plan of the research program. The significance of this student-professor relationship is obvious; and, it would appear from what has been said elsewhere, that this is not necessarily always the case in the European system of higher education. I was impressed, also, by the personal attention given to his students and collaborators by Professor Karrer, who had extreme demands made on his time. Regular twice-daily conferences in the laboratory were the rule, rather than the exception. At these times, opportunities to discuss problems and to suggest designs for further steps in the research program were provided the student.

The Swiss are a proud people, and, I dare say, they have reason to be. But this pride, in my experience, did not reveal itself as egoism. In conversations with both students and faculty, the interest in and the respect for the American system of higher education, while being foreign to many of them, was evident. The system which requires little in the way of attendance at lectures in formal course work, and virtually no examinations until the candidate presents himself for the final comprehensive examination is, I believe, of growing concern to many of these students, if not to some of the faculty. It would appear that there is a tendency on the part of those most disturbed to take a closer look at the present system which supports the concept that it is not necessarily the concern of the faculty member that the students attending his lectures are grasping the subject matter, but rather that there will be a few scholars over the years who will be moved by his achievements and will take such interest in his specialty as to become, eventually, a member of his research group.

An interesting matter, which perhaps might not rate a place in this discussion by those close to the program, concerns my observation that a healthy, but very spirited rivalry exists between the faculties of the University and of the Swiss Federal Institute of Technology. The close geographical proximity of the two institutions, as well as the relative differences which exist between the two as applied to material wealth, no doubt contributes to this relationship. Because

the University of Zürich, with particular reference to the Chemical Institute, is supported only by tax funds from the Canton of Zürich, whereas the Institute of Technology gets its support from funds made available to it by the people in all of Switzerland, there may be cause for some stress and strain, applied specifically to equipment and facilities. A visit to the laboratories and lecture halls in representative areas of both institutions does, in fact, bring this into focus. I would hasten to point out, however, that it was not my experience to be hampered in any way for want of equipment in conducting my research at the University. Had I left behind an operations and equipment budget of unlimited proportions when I went to Zürich, I might have been somewhat disappointed in what I found there. But, in retrospect, I cannot say that this was true.

PHARMACEUTICAL EDUCATION

Turning now to another area which I believe will be of general interest, and which, because of the pressure of time, could not be explored thoroughly in person, the following section is based on information made available to me by a member of the International Pharmaceutical Students' Federation and concerns pharmaceutical education in Switzerland (3).

To become a registered pharmacist in this country, a student, after graduation from the *Gymnasium*, must pursue a course of theoretical and practical education which will occupy a period of six years. For the first year and one-half, he is required to take certain courses in botany and physics, as well as in inorganic and organic chemistry. Upon the completion of this "three-semester course," he must present himself for examination. If he is successful, he will spend the next two and one-half years in an apprenticeship program. The first part of this, called the *Praktikum*, occupies one and one-half years and consists of specialized training in a qualified pharmacy. During this period, the student spends the greater part of his time learning dispensing techniques and keeping records of his work. The *Praktikum* is terminated by another examination; the so-called *Assistentprüfung*. Success in this examination qualifies the student to become licensed as an *Assistent*, and he may then be privileged to work as a pharmacist under the direct supervision of a registered pharmacist. He must spend one year as an *Assistent*, during which time he extends his dispensing experience and learns how to manage a pharmacy, before he may proceed with his education. Following this, the student is required to enroll in a course of theoretical scientific education, called the *Fachstudium*, which may be completed in another two years. This four-semester course includes lectures in advanced inorganic and organic chemistry, pharmacognosy, galenical pharmacy, bacteriology, and toxicology. It also involves laboratory instruction in qualitative and quantitative drug assay, galenical pharmacy, pharmacognosy, bacteriology, and clinical chemistry. The entire program is terminated by a comprehensive oral and practical examination.

The beginning, or "three-semester course," may be taken at the *Technische Hochschule* in Zürich, or at the Universities of Basle, Berne, Geneva, Lausanne, Freiburg, or Neuenburg. However, the *Fachstudium* is available only at the *Technische Hochschule* in Zürich, and at the Universities of Basle, Berne, Geneva, or Lausanne.

CONCLUSION

There have been doubts expressed as to the wisdom of expending both time and money for professional study in the present-day European university, a matter which I am in no position to argue, pro or con. However, this I do know. A year of my life was enriched by experiences which shall always be remembered with pleasure and satisfaction.

Of course, the success of this venture was dependent upon the pleasant outcomes of a number of important events, but in my opinion, not the least of these was my fortunate association with an educational institution in these United States that supports and encourages participation in a sabbatical leave program. For this I am particularly grateful.

REFERENCES

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(2) Sonnedecker, Glenn, *ibid.*, 222, 169 (1958).
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With such a background of unselfish devotion to the service of mankind your outlook upon the problems of the postwar world is apt to be more liberal, more humane and much more sympathetic than that of the ordinary man toward adequate control over the forces which have used scientific discoveries and inventions to destroy rather than to benefit human beings.

Robert P. Fischelis, Am. J. Pharm. Ed., 9, 538 (1945)

THE SEMINAR AND PROJECT METHOD OF INSTRUCTION: A DEPARTURE FROM THE TRADITIONAL STYLE OF TEACHING

L. WAIT RISING

The objectives of teaching are obvious. It isn't necessary to go into great detail explaining that an instructor wants to add to the knowledge and skills of his students. Much can be said, however, about the manner in which he attacks the problem.

Traditionally in American universities the procedure is based on the lecture-recitation method. Where indicated, laboratories are added. The instructor lectures on assigned reading, quizzes for depth and intelligence of student comprehension, and provides laboratory exercises for demonstration of principles or processes. In most cases the lecture is the basic unit; the recitation and laboratory are supporting.

Under this system, the student can get by with a minimum amount of personal effort beyond that required to memorize enough material to pass quizzes or examinations. The lecture method tends to predigest education, which under some circumstances is desirable, but in general means that the instructor is doing the thinking for the students. Thus, the so-called disciplines cease to discipline. Instead, they become cushioned settees where the students effortlessly acquire an acquaintance with the subject matter while the instructor does the research, rationalizing, and explaining. Even the process of taking notes while listening to an illuminating lecture is no mental exercise, because the students are so busy writing they have no time to think.

Lectures do have their place as a means for explaining or expanding text material. For the full development of student minds, however, strong supplemental teaching tools should be used. They should be designed to force the students to research, reason, draw conclusions, and make decisions. Training in communicating the results of all these mental activities follows as a natural corollary.

During the past several years I have been experimenting in a senior class with the use of seminars and projects as the instruments for accomplishing these objectives. In describing them it is not my purpose to claim invention or to ascribe to them miraculous academic results. I do believe their use where possible achieves the following:

1. Greater interest in the class work.
2. Greater utilization of the student's mental capacity.
3. Better understanding of the subject matter.
4. Better development of student initiative and ingenuity.
5. Better training in communication.
6. And, in my own course, a much sharper focus on the problems of pharmaceutical practice.

The time for the seminars was taken from a weekly recitation period. The class is divided into three small groups (sixteen to eighteen students) which meet once a week. Seminar assignments are the same for each member of the class. They are based on current lecture material or current problems in practice pertinent to an area of instruction. The class is briefed on the reasons for each assignment and the teaching results expected from it.

When the sections meet, as many students report as time permits. One of the objectives of seminar teaching is to examine the thinking of a group on specific problems. At the conclusion of individual presentations, class discussion revolves around such points as clarity of expression, logical approach, validity of statements, and whatever else might be pertinent for a given subject.

The fact that each student knows he will be on the defensive when his report is given stimulates his best preparation and presentation. He tries his best to be sound in approach, reasonable in argument, and correct in presenting his facts.

There is very little duplication in style or organization. An amazing number of distinctly different points of view or methods of attack are evidenced at each seminar. At the conclusion of the hour, every student has been inoculated with new thinking, new ways of doing things, new philosophies on subjects where differences of opinion are possible. Use is made of the old adage that "many heads are better than one."

A typical list of seminar assignments follows:

Jan. 3 Two to four paragraph letter to your local physicians calling attention to a new refrigerator you have installed which is specially designed for biologicals and other drugs requiring storage at low temperatures.

Jan. 9 Two to four paragraph letter to your local physicians describing your improved filing system for literature on all types of pharmaceuticals and inviting its use at any time.

Jan. 16 An *outline* of a twenty-minute talk you are to give before your local medical society on the services you believe pharmacy offers the doctor and his patient.

Jan. 23 An *outline* of a twenty-minute talk you are to give before one of the local service clubs on the place of pharmacy in the community.

Jan. 30 A discussion of what you believe are the responsibilities of your employees to you and your pharmacy.

Feb. 6 An *outline* of a forty-minute talk before your state association on the manner in which you think the professional areas of pharmacy, particularly the prescription department, should be promoted.

Feb. 13 A brief explanation to a customer explaining why it was necessary to charge more for a refilled prescription than its original price four months ago.

Feb. 20 A five-minute discussion of your opinions on whether a physician should be asked to prescribe generic names or brand names when a choice is possible.

Several weeks of the seminar time are devoted to reports on unassigned reading in current professional literature. The criteria for choice of selection are usefulness of the material in the practice of pharmacy and the student's ability to illustrate this utility at some time during his presentation. After the report, no one should be able to say with justification, "So what?" This training develops the habit of reading for a purpose. It teaches discrimination.

The project portion of the course requires cooperation from many local pharmacists. Seattle is fortunate in the large number of pharmacies willing to help the college give instruction at the professional practice level. All projects require a certain amount of work in a pharmacy. Why this is true will be seen by reading the assignment which follows:

Senior Vitamin Project

Work in teams of two.

Cooperate with the pharmacists where you do your work by not interfering with their activities. Remember they are generously acting as clinical instructors helping you learn the practical aspects of vitamin therapy and merchandising. You are doing this study to learn the practical aspects of vitamin therapy and merchandising. You are doing this study to learn how the physicians prescribe and public uses vitamins, and how the pharmacist functions as distributor. This is an important area in pharmaceutical practice.

With the pharmacist's permission do the following things:

1. Take a complete inventory at cost of his vitamin stock, both OTC and prescription. Include those products with mineral supplements. Include only formulas whose principal ingredients are vitamins. With the pharmacist's help, figure his turnover and compare it with that of the rest of the pharmacy. Determine how turnover could be improved.
2. Make a table showing

Name of Product	Package Size	Maker	Cost Price	Selling Price	% Gross Profit	$ Gross Profit

In calculating cost, consider all discounts, i.e., deals; also free goods.

3. Analyze individual formulas, on basis of dosage units, in an effort to determine the best values for the customer.
4. Analyze the table (2) for items most profitable to the pharmacy. Are these the items you selected in (3) above?
5. Discuss the pharmacy's selling effort, using the following points as a basis:
    1. Location of vitamins in the pharmacy.
        What dictated the choice of location?
            Advantages
            Disadvantages
    2. Methods of display.
        Islands, counters, shelves
        Cards, windows
        Etc.
    3. Types of sales stories given customers.
        Price to customer
        Therapy
        Etc.
    4. Which items or company products are pushed?
        What influences choice?
            Formula
            Quality
            Push money
            Price to customer
            Etc.
6. Discuss the pharmacy's buying policy on vitamins.
    1. Which manufacturer gets the largest orders? Why?
        Faith in company?
        Friendship with salesman?
        Price?
        Exchange policy?
        Etc.
    2. Does the pharmacy buy deals, or daily replacement needs?
    3. Is a fixed per cent of the inventory dollar allocated to vitamin purchases? If not, how does the pharmacist decide how much to buy?
7. Make a table of product information on each vitamin that will help sell it. This will include function and recommended dosage.
8. Do the same for the minerals used as supplements.
9. Make a list of the reasons why people buy vitamins. Do your product information tables (7 and 8) have the answers to 9?
10. Discuss the door-to-door and mail order competition.
    1. Names of competitors
    2. Names of items
    3. Price of items
    4. Technics for advertising and selling
    5. Strong and weak points of their selling program

11. Discuss the ways in which the pharmacy can meet this competition.
12. What do you think of the wisdom and value of a dietary supplement department in the pharmacy? This would include all diet supplements, medicinal foods, if any, or whatever else the pharmacy stocked that has a direct connection with therapy through nutrition.
13. What items would you stock for a "therapy through nutrition" department?
14. List points which were not specifically mentioned in the project outline, that have occurred to you during the study as worthy of attention.

Each team is given a form letter which serves to introduce it, the project, and the reasons for asking the help of the pharmacists.

> This will introduce ————————, seniors in the College of Pharmacy. They are taking Pharmacy 314, a course in which we are trying to bridge the gap between theoretical training and the solid problems of actual pharmaceutical practice. This obviously requires contact with pharmacies as well as classrooms. To get that contact we need your cooperation.
>
> We would like to presume on your patience, good nature, and willingness to help us make available each year a new group of graduates who will have some experience in the problems of pharmaceutical service and management. Your assistance now will make the task of assimilating new employees later on much easier, and it will greatly strengthen our teaching.
>
> Would you grant these students the privilege of studying some of the departments in your pharmacy from such points of view as inventory, turnover, location, display, and possible improvement in merchandising? Where these projects have been carried out in the past, they have generally furnished helpful information to the owner and have been the best sort of training in the problems of management for the students.
>
> You, in effect, become a clinical professor supervising one of the most important areas of the student's practical training. The resulting improvement in the caliber of our graduates is so plain that it needs no elaboration.
>
> Fundamentals of operation, not personal information about the business is the focal point of each project. Each student recognizes that if he is permitted the courtesy of study in any pharmacy, he owes its proprietor the responsibility of a young employee.
>
> Will you help us?
>
> Sincerely yours,
> L. Wait Rising
> Chairman, Dept. of Pharmacy
> and Pharmacy Administration

Since only about thirty clock hours a quarter can be devoted to projects, there are ordinarily but two completed during that time.

Some of the purposes served by the projects are:

(1) Students are introduced to the use of practical research and methodical study for problem solving in the practice of pharmacy.
(2) Students learn to assemble data and draw conclusions upon which policy or procedure can be based.
(3) Through writing reports, more skill in problem analysis and communication of ideas is developed.
(4) Cooperating pharmacists are frequently helped in their own thinking or approach to difficult or neglected management situations. This comes about through the data collected in the study, or as a result of ideas developed in conference with the students on various phases of the problem.

Another set of teaching tools that can be put to practical use in this style of instruction are the various pharmaceutical catalogues and price lists. It is important that their value to the practicing pharmacist be understood by the graduating seniors, yet many leave school with only a vague conception of their full content or broad usefulness. Every senior can be made aware of the information available in them and given a practical demonstration of their utility by means of projects involving content analysis of several catalogues and problems requiring their use as pharmaceutical handbooks.

A good beginning is first to have the students make a list of the subjects covered in one of the newer catalogues. One excellent "text" is the 1958 Upjohn catalogue. It is typical of the new approach to price list composition designed to make the lists sources of product information and other data so necessary to the daily operation of a pharmacy.

Once the list of subjects is compiled and the students know where to look for answers, they can be given sets of problems where questions of company policy in relation to deals, returned goods, credit, etc., and product information for the physician must be answered.

By way of illustration, the subject matter covered in the Upjohn catalogue is divided as follows:

I. General information, which is an introduction to the product lists.
- Date of issue of the catalogue.
- Home address of the company.
- Date of founding of the company.
- Map of the United States showing the regional sales divisions and the location of the branch offices. The addresses and phone numbers of the latter are listed.
- Foreign subsidiaries and their addresses are given.
- Upjohn trade marks are listed.
- Explanation of the symbols used in the catalogue.
- Statements covering policies concerning:
  - Integrity of goods
  - Package size availability
  - Price fluctuations
  - Title and risk
  - Breakages and shortages
  - Terms of purchase
  - Exchange procedures
  - New accounts
  - Narcotic orders
  - Requests for new labels
  - Completeness of formulas
- Indexes
  - Pharmaceutical types
  - Pharmacologic types

II. Main portion of the catalogue, which is an alphabetical listing of products. Index tabs separate alphabetical groups. Educational pictures are on these showing plant scenes and processing equipment. Important information available under each product listed is:
- Formula
- Description
- Indications
- Dosage
- Package sizes and prices
- Descriptive symbols
- Other products in which the active constituent is used
- Special comments on methods of administration
- Obsolete names, if still in common use

Catalogue editors are practical men, operating within a budget, so they are not going to incorporate material that serves no useful purpose. There is a substantial reason for everything included. For a better understanding of the "why" of catalogue content, the first portion of our project can be a point-by-point analysis of what purpose the student feels is served by each subject listed. What impelled the editor, for example, to include the names and locations of foreign subsidiaries?

For the second part of the project a series of hypothetical but nevertheless reasonable situations can be set up for student solution through reference to the catalogue. Here are some suggestions:

A pharmacist has been purchasing Delta-Cortef tablets, 1 mg. scored, in bottles of 100. Prescription demand increases to the point where it would be practical to buy them in quantities of 1000. This is certainly a simple situation, yet it offers more than ordinary opportunity to search the catalogue. The student first turns to the alphabetical listing for Delta-Cortef where he finds that buying in 1000's cuts the list price of each tablet from 7.43 cents to 7.05 cents. He discovers the quotation for 1000's has no stock number in parenthesis in front of it. Reference to the section on symbols reveals that the omission means bottles of 1000 tablets are not available even though they are listed and priced. Examination of the section "Package size availability" tells him that a sufficient number of 100 tablet bottles will be sent to fill the larger order and that the price will be that quoted for 1000.

The pharmacist ordered a gallon of some elixir at the quoted price of $17.09. Later, when the bill arrived, the price was $20.18, because in the meantime raw material costs had risen. Does the pharmacist have to pay the higher price? He is told in the section on prices that he does. This section explains that prices are subject to change without notice. Unfilled orders will be billed at the price prevailing at the time of shipment.

What can the pharmacist do if he overbought on some pharmaceutical and would like to reduce his stock to a more practical basis? The student pharmacist finds the answer on page VII under "exchanges." He is told that listed items in unbroken packages purchased less than a year ago can, under certain conditions, be exchanged. The conditions are stated.

A doctor wants a preparation which will permit him to feed parenterally a patient suffering from malnutrition. He has heard of Lipomul I.V. and asks his pharmacist what it is and how it is administered. The answers are found on page 113a, where the full formula, description, discussion of indications, and the location of details concerning dosage and administration are set forth.

From the catalogue the student learns the following things about Lipomul I.V.

1. It is a sterile emulsion of the oil-in-water type.
2. It is a prescription only preparation.
3. It is for intravenous use only.
4. Its nutritive elements are cottonseed oil, anhydrous dextrose, and lecithin.
5. Its caloric value.

6. It is the first and only intravenous fat emulsion suitable for extensive clinical use.
7. How it is prepared.
8. The emulsion exerts no osmotic effect, and does not irritate venous endothelium.
9. Is not excreted in urine or feces, but is completely metabolized.
10. It is used for malnourished patients being prepared for surgery, patients whose gastrointestinal tracts are not functioning normally, patients with extensive burns, and so forth.
11. The directions for dosage and administration schedules accompany the package.

Presume that the physician has a constipated patient to whom he does not want to give the standard laxatives. He asks his pharmacist about a substitute such as one of the new fecal softeners. The pharmacist doesn't know the answers. He quickly looks in the pharmacologic index under fecal softening agents and is referred to Polykol (page 173) where the essential information is available.

A doctor is undecided whether his patient should be given Adrenal Cortex Extract intravenously or Solu-Cortef sterile, so he calls his pharmacist for information. By referring to "Indications" in the catalogue description of each product, the pharmacist can immediately tell the doctor how the two differ and something about differences in conditions best met by them.

A farmer has heard about Veterinary Parvex as a possible vermifuge for his hogs. He asks the pharmacist about dosage and administration. Both questions are fully answered by means of the catalogue.

These few examples illustrate how uncomplicated real-life situations can be easily built up in sufficient numbers to teach thoroughly the use of pharmaceutical catalogues.

It is difficult in the limited time available for this paper to do more than present a general plan for this sort of teaching. A full discussion would do such things as bring out the strong and weak points, indicate the wide scope of seminar discussions, the variety of project subjects, the areas of greatest good for the students, and the willingness of the practicing pharmacist to act as clinical associates where necessary.

There are problems, as is true with any teaching plan. In the projects, for example, some students with little or no experience but a missionary zeal will attempt to reshape methods a pharmacist has been following for years. Minor incompatibilities result. All things considered, however, the seminar and project method has much to recommend it wherever the nature of a course will permit its use.

There cannot be an end to war until men are no longer at war within themselves.

Curtis Bok, Am. J. Pharm. Ed., 7, 289 (1943)

HOW WELL DO WE TEACH PHARMACY?

CHARLES O. LEE

INTRODUCTION

As an apprentice and later as a student I became impressed with the fact that studying pharmacy was largely a matter of memorizing assigned masses of data comprised of chief constituents, botanical orders, habitats, actions, uses, and doses. And I have a feeling that some of this kind of cramming still goes on today. Classroom work carried on after this manner puts the teacher in the role of a quiz-master which is a hard one. Personally, I have never enjoyed this kind of teaching. Gibson (1) refers to it as "peripheral education" in pharmacy. He says further that, "Rote memory is necessary when material demands it, but I think that it is cruelly wasteful and educationally detrimental when used upon material that has logical associations and which can be attached to already existing systems."

Men of my generation came up through the cram school age when pharmacy was studied, taught, and practiced as a trade. No wonder educators of today are finding it hard to elevate pharmacy to a respectable professional level. I have witnessed much of the struggle between the cram school and organized pharmacy. The cram school has lost out, but its old cramming system of teaching lingers on here and there.

My experience and observation with the cram school idea of teaching and learning convinced me early that it was an unsound system. In teaching pharmacy the learning of certain facts is necessary, but facts are no longer sufficient. Pharmacy cannot, any more than any other profession, come into professional full bloom except through a knowledge and an understanding of the fundamental principles, processes, and theories on which it is based. Brodie (2) expresses the problem well when he says, "First, the teaching of pharmacy will call for greater emphasis on scientific fact and principle. Pharmacy is an area of applied science, an area where both biological and physical principles are brought to a reality in the preparation of medicinal agents." And he says further, "the teaching of pharmacy will require a greater professional consciousness and a more aggressive approach to professional problems."

Speaking of pharmacy, Hardt (3) says, "Today as well as in the future, the pharmacist is and will be the therapeutic consultant to the physician and not the handmaiden he once was. If this be the pharmacist's primary function, how must he be trained?" He answers his own question by saying that the pharmacist needs a better education, the kind that will make him a specialist in modern therapy. To the writer there is much to indicate that our teaching in the future will have to be shaped to that end.

Not too long ago Clevenger (4) said that "the degree is the thing." And he went on to say that "since the second World War the emphasis has shifted from the college education to the college degree. For an increasing number of jobs the bachelor's or master's or doctor's degree is simply a sort of a glorified union card. With it you qualify for the job; without it you simply haven't a chance." He says also that the students know these things and mark time until graduation day. Furthermore, "the shift of emphasis from education to the

degree constitutes the greatest need for better teaching in our colleges and universities. If students no longer come to college inspired to learn then something must be done to inspire them after they come." This is a challenge and a task for those of us who hold pretty closely to the fact, theory, and usefulness of our subjects in both the classroom and laboratory. Clevenger says also that he feels that "college professors have tended to look with disfavor on any attempt to improve teaching techniques," regarding such as sugar coating or spoon feeding which of course, it need not be.

There is no gainsaying what these authors have said about the pharmacy curriculum subject matter, misplaced educational emphasis, and the reluctance of teachers to improve teaching techniques. Any improvement of these problems falls on the teachers and at the same time indicates the necessity for a much better job of teaching of both fundamental theory and laboratory techniques. Professional men must not only understand what they are doing but also how to do it properly and why.

Since pharmacy is an applied science and since pharmacists are laboratory specialists whether serving at the prescription counter, in the control division, or in a research laboratory I feel that the undergraduate pharmacy laboratory is the place where our best teaching should be done.

HOW CAREFULLY DO WE TEACH LABORATORY WORK?

My interest in the teaching of pharmacy, including laboratory instruction, has extended over many years of experience and observation. In 1929 DeKay and Lee (5) discussed the four year course in pharmacy. They pointed out then that the old adage, "We learn to do by doing," did not seem to hold too well with respect to laboratory instruction and concluded that "about seventy-five per cent of the time spent in the laboratory is a waste of time for a great percentage of the students." As for myself I have concluded that this apparent failure cannot be blamed on the laboratory *per se* nor on the students but largely on the teacher. Time in the laboratory can be and must be made an important aid to the learning process in any applied science course, especially in pharmacy.

So far as I can learn very little work has been done in evaluating the effectiveness of laboratory instruction. This is an aspect of our educational program that deserves study. Laboratory work is a relatively expensive part of our undergraduate program, and it also adds greatly to the cost of our graduate and research efforts. It seems not unreasonable to ask ourselves if the laboratory is worth what it costs. Since this type of instruction is costly it would seem the better part of wisdom to see that those who take laboratory work are carefully instructed and trained by good, experienced teachers. But I feel that too much of our laboratory teaching is done or has been done by poorly trained, inexperienced, and uninterested graduate students. What an educational travesty!

In anticipation of the difficulty I would have with this topic I wrote recently to a well-known educator and asked if he had made any studies of the problem of what or how to teach in the laboratory. He replied that he had not. He also said, "your own experience will, so far as I know, have to be your best guide in the problem of laboratory instruction in pharmacy. I quite agree with you that exactness and correctness here are of the utmost importance." (6)

As I recall my undergraduate college days I remember that some of the laboratory instruction was of very poor quality, but I was not wholly aware of it at the time. Students apparently do not know or care enough to demand the best in education as they do in most other dealings. On the other hand a few of my undergraduate laboratory courses were well taught. Among them were courses in physiology, bacteriology, and plant anatomy.

In recent years I have grown keenly aware of my own shortcoming in teaching laboratory work. This has alerted me to the possibilities and opportunities for better teaching in this area of learning. If we believe that students learn by doing we may logically conclude that since, in much of our laboratory work, we do many experiments but once, the learner or beginner will do much better work and learn more if he is carefully guided and directed. Even so, just recently my class in preparations was making ointments by incorporation. At the beginning of the period I carefully demonstrated the process of levigation with explanations. In due time I went around the laboratory only to find that many modifications of the demonstration were being used that required much more time and effort than I had used. The point is that the meaning and purpose of the process and demonstration had been missed by many students. Can I do otherwise than attribute this to faulty teaching?

Many years ago I presented a powder paper prescription to the freshman, sophomore, junior, and senior students at Purdue. In those days the courses in preparations were taught to the freshmen. The papers were collected and weighed. To our disappointment and surprise those of the freshmen class were the most accurate. That confirmed my belief that upperclassmen tend to become careless with simple tasks. This means that those students had not gotten the idea of careful professional practice into their thinking. Again, most likely due to poor indoctrination.

I must confess that I have taken too much for granted through these many years of teaching, by assuming that when I had explained, demonstrated, and discussed the lesson and laboratory assignments carefully that I had done my full duty. The rest was up to the student. With some of the students that holds true but not for all of them. I have come to believe that explanations are not enough. Demonstrations, even though carefully done, do not get across to all of the listeners in a large class. Following a demonstration of an important laboratory process the head professor or others in charge should observe the students as they perform the exercise. Even though they saw the demonstration executed, certain of the students will act as though they had not seen what went on. It is then necessary to work with them, even to the point of directing the simplest manipulation. Even then close personal instruction is no guarantee that the student has gotten the idea or will retain any part of it. Nevertheless, we as teachers are obligated to follow through on our avenues of instruction as long as there is hope.

I have arrived at the conviction that we must do a better teaching job (a) because I believe with Johnson (7) that "—we must raise the prestige of learning." (b) Students come to us poorly prepared to do college work; therefore we must know our students well enough to pass on their qualifications with certainty. Knowing how they perform in laboratory is a great help in grading, and grades are so important to the students. (c) The laboratory affords an opportunity for us to judge the students' interest, accuracy, and skill. Aside from examination grades this helps us to determine which of the students, in addition to

personality qualifications, should be encouraged to practice pharmacy and/or do graduate work. (d) It is my sincere belief that many students have been graduated in pharmacy wholly on the basis of grades who otherwise lacked the qualifications of a professional man. Doubtless we have all had students who made passing examination grades but were not generally good students. We must find more reliable means of evaluating professional fitness than by grades alone.

WHAT OTHERS SAY ABOUT LABORATORY WORK

If we are going to insist on laboratory work we are educationally obligated to make it meaningful. While most of the laboratories that I have observed were conducted in an orderly seriousness there was much lost motion. Others were apparently of very little worth or value.

Many years ago Griffith (8) said, "In my opinion laboratory work is essential with the beginning course and I shall give my reasons for this opinion." They were that students cannot develop techniques by just watching but by doing. They learn to coordinate their hands with their thinking, to handle delicate equipment and get accustomed to working with minimum quantities of materials.

In opposition to a recommendation that the course generally known as pharmaceutical principles and processes be deleted from the pharmacy curriculum because it represented a duplication of subject matter in other courses, Burt (9) stated that even though the courses are elementary and duplicate many principles and processes that are taught in chemistry, physics, and biology they are taught with little reference to the principles involved. He further contended that if we did not teach these processes in a separate course that they would have to be integrated into the other courses in pharmacy. He stated also that "The laboratory method has particular significance in the teaching of pharmaceutical technique and is considered indispensable to a course of study in this area."

We never seem to be able to agree on what is important and not important in our curriculums, but there is a limit to the amount of integration that can be incorporated into a major pharmacy subject. This can only be done successfully when and if our students are carefully instructed and trained in the major subjects which are fundamental to pharmacy such as chemistry, physics, and biology.

In speaking of the laboratory method Pella (10) says that it is not easy to define but "It provides for direct contact with materials and apparatus." He goes on to say that "as teaching methods advance doubtless more time will be given to laboratory work with less to formal recitation and lecture. The laboratory work will eventually become a place where the student asks the questions and finds answers under the guidance of the teacher." He also expresses the feeling that the laboratory work should be closely correlated to other class work. And that the laboratory should be a place where the student is an active learner and is able to develop certain skills. To accomplish these things skilled teachers are needed. However, there is no guarantee, says Pella, "that a student will learn to think more carefully in the laboratory than in any other place."

If there is any purpose to this paper it is to give emphasis to the need for better teaching in the laboratory. Pella stresses this idea over and over, and I sincerely urge all of you teachers to peruse his paper, cited above, very carefully.

In another paper Pella (11) refers again to skills and says (a) "That to develop skill in the use of a thing such thing must enter into the learning situ-

ation. We gain skill weighing materials by weighing materials. (b) To develop an understanding of a thing outside the student's experience that thing must be brought into his experience. The student may know something about preparing Brown Mixture but doesn't understand it until he prepares it." However, Pella does not imply that the student's experience in making a product necessarily endows him with a complete knowledge of all that has gone on in compounding it. It has been my observation that it is the rare student that recognizes the incompatibles that are possible in Brown Mixture and in many similar products unless much emphasis is given to that aspect of the formulation.

This points up very clearly my contention that students make preparation after preparation just for the sake of making a product with no clear idea of the why or wherefores involved. It is not the student's fault that he has not been led to ferret out all possible incompatibilities and other difficulties of compounding. The subject of incompatibility might well be integrated with the making of a preparation, but too often it is not done, especially in beginning courses.

Sciuchetti (12) and coworkers give emphasis to two things that I have always tried to do in the laboratory, namely, not to stress quantity of work done as against quality of products made. The writer has found that students seem often unable to distinguish between a good and a bad product. All one needs to do is to compare the preparations of a class. If it is a colored product the results will exhibit a great variation of shades and tints of the colored solution. I usually attribute this to inaccurate measurement of the coloring agent, and while I exhibit the products and call attention to the color variation I do not feel that there is much to be done about such irregularities with practice preparations except to appeal to the students to be extremely careful in all measurements. I repeatedly remind my classes that the tools they use, such as balances, weights, cylinders, and graduates, are more accurate than the men who use them and that the least they can do is to be extremely careful, and that the most variable factor is the human being.

In an effort to stimulate student interest in their work, McDavid (13) reports an experiment in teaching pharmaceutical preparations by the project method. Students are permitted to choose their projects but are not expected to complete them. However, for an A grade students are required to search the literature on the subjects and write up their projects. The object of this method of presenting the subject is to teach the fundamentals of scientific research and to master the attitudes and disciplines for solving problems. McDavid feels that students who follow this plan of study develop independence of thought and become more critical and analytical of their own work, and often suggest improvement. This is very commendable and points the way to better teaching.

TEACHING AND TEACHING

There is no intention, in this review, to overemphasize unduly laboratory instruction. The writer feels, however, that since one has the chance to work closely with the students in the laboratory, more should be made of that opportunity.

The teacher is, after all, the keystone of the arch of our educational program. What he says and does are important, but how he says it and how he does it can be even more important.

In 1952 Darlington and Clift (14) made an extensive survey of the methods and procedures for the teaching of pharmacy. They summarized their study as follows: "Other than the standard lecture, laboratory technique, there were infrequent publications on the use of demonstration, discussion, student report, conference, visual, audio-visual, visiting speaker, and group project methods or procedures of teaching." But no method of validating the effectiveness of a given teaching procedure was offered. These authors pointed out that Dr. Lyman in his Report of the Committee on Problems and Plans in 1949 said, "A common complaint is that there are not enough papers which deal with the mechanics of teaching." Dr. Lyman seemed to feel that this problem should have the attention of the Teachers' Conferences, and I believe that he was right.

In discussing the recent advances in accreditation in 1949, Dr. Elliott (15) complained of much drab and uninspired teaching that went on. He said, "Rarely did I see and hear a classroom performance, carried on by one who had a clearly planned job for the hour, who spoke clearly and simply, who displayed an appreciation of the student's difficulty of receiving and absorbing massive doses of purported facts. Too often the so-called lecture was a vocal multiplication of the material to be found in a standard textbook which the student himself would read more quickly and less painfully. It is the teacher who breathes life into the curriculum."

Blauch (16) in referring to teaching said, "Let there be no mistake about it: Teaching is a creative work which calls for broad and profound scholarship." Concerning the lecturer Pella (10) says that he should know his students, be impartial, sincere, human, patient, and not sarcastic. Moreover, he should exhibit enthusiasm about his subject, speak at a moderate rate with a clear, well-modulated voice and use proper English and correct pronunciation. He should enjoy working with students and reveal his pleasure to them. Pella (11) again says that, "The teacher is the presenter of stimuli," but that what he believes, desires, knows, or thinks teaches no one. "The resources of the teacher must be found in what he can do to create situations which will cause students to react."

In referring to the pharmacy teacher, Darlington and Clift (14) in their survey say that, "The teacher of pharmacy occupies a dual role in that he should be a highly competent person in the profession as well as a student of higher education." I have to agree with them, but we as teachers of pharmacy have not given much attention to the art, science, and psychology of professional education.

SUMMARY

It is hardly necessary to point out that this critical review has reached out in several directions for ideas, suggestions, and criticisms. The results are not soothing but challenging. And, you may ask, where does it leave us?

The best part about it is that we can be critical of ourselves without losing our sense of direction and purpose. Furthermore, it is hoped that we may be stimulated sufficiently to sit down together and build a curriculum that will, if properly executed, produce pharmacists that are capable of doing all of the professional tasks that should be expected of an alert, well-trained modern specialist.

For us as teachers the task is, as I see it, that of getting together and deciding on a unified curriculum for our basic pharmacy courses. This should not necessarily lead to the dreaded standardization so often mentioned because no subject is ever presented alike by any two teachers. After all it is not the subject but the teacher that sparks a school's reputation.

This suggestion of unification stems from a recent review of our pharmacy school catalogs. What a motley lot of course descriptions one finds there for any course one chooses to review. To me they are striking examples of chaos which a program of standardization could rectify.

Teaching is a challenging, creative profession, and I hope that the dissatisfactions that arise from teaching can be attributed to creativeness.

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The war against disease and premature death will continue long after the last shot has been fired in the Far East and our armed forces have returned to the pursuits of peace. It is a never-ending war and you have enlisted for the duration. So you will march from now on in the army which has been recruited and trained to serve humanity in the quest for better health, better living conditions, and longer life.

Robert P. Fischelis, Am. J. Pharm. Ed., 9, 540 (1945)

AN EXPERIMENT IN TEACHING THEORETICAL AND APPLIED PHARMACY

T. W. SCHWARZ

The problem of how to teach each student according to his capacity and yet cover a required number of topics in a uniform manner has baffled teachers at every level of our educational system. The teacher in a professional school is probably as much fazed by this dilemma as a teacher in high school. Unlike the student in a liberal arts college, the student in a professional college has to take a prescribed core of courses with little room left for elective choices.

The success of a student in a professional school depends on three factors: (a) intellectual capacity; (b) subjective endeavor; and (c) professional orientation and adaptability. While the spread in intellectual capacity and in subjective endeavor between the top and the bottom members of a class is as marked as in any college class of the same size, professional ability and experience do not necessarily parallel the rating of the students in the other two factors. Often we find a student who has, from his experience behind the prescription counter, a good understanding of the problems of the profession and a mastery of many of its skills.

In the courses that deal with pharmacy subjects mainly, these three factors affect the extent of the student's understanding of the subject matter and his participation in the laboratory exercises and in conferences. A student with good experience background but low capacity for learning often improves his poor scholastic standing by his performance in pharmacy courses in which his insight and motivation help him to attain better grades. Students with good experience and high capacity for learning extend the range between top and bottom of a class at the top, while those with no or no worthwhile experience and a mediocre capacity for learning stretch the range at the bottom. Altogether a class in pharmacy is a heterogeneous group with regard to background and qualifications, to whom we as teachers want to impart a maximum of knowledge and skills. Between that maximum that we, the teachers, hope to attain, and the minimum, which a sizable portion of the class hopes to get by with, we have to maintain a rate and a level of progress which will keep the students at the rear from getting lost and those at the front from getting bored.

This problem has increasingly bothered me since I took over the teaching of a major pharmacy course in our curriculum. This course, Theoretical and Applied Pharmacy, is a nine-unit course required of the students in their third professional year, and is followed by the course on prescription practice. It is a year's course, consisting of five units of lecture and four units of laboratory. The laboratory is divided into two sections of forty students each. Prior to my course, the students have had a good deal of chemistry, but relatively little pharmacy, which consists of an orientation, a course in pharmaceutical mathematics, a two-unit course in inorganic pharmacy, and a three-unit course in pharmacognosy. Concurrently with my course, all students take six units of physical chemistry, which consists of an equal number of lectures and laboratories spread over two semesters.

During the first semester of my course I have to establish a common denominator of knowledge and experience. Before the end of the first semester I usually have gained a pretty accurate picture of every student's standing with regard to the three factors mentioned earlier. The problem of holding the interest and utilizing the abilities of all students in the class as much as possible has always become acute in the second semester. In the past, I have tried to entice a few capable students to engage in additional work associated with topics of the course. This has never been satisfactory, mainly for three reasons: (a) too few students were successfully approached; (b) those who participated lacked sufficient drive to accomplish something when they were left largely to their own initiative; and (c) altogether they had too little time, although they were excused from some of the regular laboratory assignments.

In the spring semester of 1956 an opportunity for a bolder approach arose. It was the first time that the six-unit course in physical chemistry was required of all students. Previously, four units of physical chemistry were required in the fall semester, while two units of a follow-up course were elective. The class was smaller than usual: fifty-nine students as compared with the usual eighty. I decided to divide the class into two sections and put all students, who according to the three factors scored in the upper half, in one section. Answers from an experience questionnaire gave me an accurate picture as to the extent and value of everybody's practical experience.

The sectioning of the class according to scholastic performance and ability was a novelty in our school. Whether the sections were arranged on a voluntary basis, or by alphabetical order, or by any other system, each section always managed to have about the same distribution of good, average, and poor students. It was precisely this standard distribution which I wanted to avoid. I had here two groups who had to take the required five units in the spring semester of the second to the last year. One group was given the regular laboratory assignments. The other group was given a few key preparations and experiments, but mainly was assigned special projects. Each member of the latter group was given a choice of changing to the other routinely conducted section. Twenty-seven students were picked and divided into nine subgroups. Each subgroup was under the direction of a teaching assistant or a staff member, and each teaching assistant in turn consulted with me on the progress of his unit. The students in this group knew that I expected a superior effort from them, and at the same time I relaxed the ordinary discipline of the laboratory so that there would be no feeling of compulsion. I realized that this privilege might be abused, but my main purpose was to incite interest and enthusiasm above and beyond the ordinary; to give the students a greater feeling of satisfaction; and to have some worthwhile pharmacy projects pursued.

I am greatly obligated to Dr. Frank M. Goyan. Much of the students' work required instruments in the physical chemistry laboratory, which is Dr. Goyan's domain. His advice and help contributed immeasurably to carry through this experiment in teaching.

In addition to two faculty members (including myself), four teaching

assistants participated in guiding the students in their projects. The following projects were included:

1. Adsorption of methyl salicylate from its aqueous solution on various filter aids.
2. Comparative rates of hydrolysis of acetyl salicylic acid in water, alcohol, propylene glycol and polyethylene glycol 400.
3. Comparison of equally viscous solutions of thickening agents in suspending sulfur or zinc oxide.
4. Evaluation of various nontoxic waxes and their combinations as substitutes for cacao butter in suppositories.
5. Evaluation of acetylated monoglycerides (Myvacet and Myverol of Distillation Products Industries) as ointment base and suppository base components.
6. Crystal formation in the system carbowax-water-hexanetriol.
7. A study of technics for applying newer enteric coating materials extemporaneously.
8. Rate studies of the release of salicylic acid from various ointment bases.
9. Preparation of Coal Tar Solution made with Myrj 51, and its comparison with the USP XIV and USP XV formulas.

Pharmacy teachers will readily appreciate the potential usefulness and the basic principles involved in these projects. Of nine projects, the second was brought to completion and, with the inclusion of some additional work by the same students, was subsequently published (1). Another project (No. 8) was well on its way when a paper published in April, 1956, reported on the same project showing results similar to those we had obtained and the use of similar technics (2). A third project (No. 6) was successfully completed and readied for publication when a paper dealing largely with the same subject matter appeared in print (3). Three projects (Nos. 3, 4, and 7) had to be terminated without being completed. However, work on two of these projects has been resumed, and the results of one are encouraging enough to plan their publication. Further work on another of these three projects, which were left incompleted, proved our approach to be unfeasible. The remaining three projects got nowhere.

The next two questions are obvious: (a) Did I accomplish my original intention? And (b) was it worth it?

Measured in completed and published projects, the success was small. But publication was not the goal. It was, rather, the attempt to give the student a challenging problem, which he was equipped to handle under proper guidance, and which was commensurate with his ability. In this respect the experiment succeeded fairly well. It also succeeded in tying two areas of the curriculum together: physical chemistry and pharmacy. The experiment was not an unequivocal success because the undergraduate student, no matter how capable, is rarely as conscientious or as persistent as a more mature investigator. The students' attitude was good, and so was their cooperation. They liked the freedom to do work more at their own convenience, which sometimes meant hardly at all. I expected them to perform more according to my pace. Often, to get ahead with the work at a reasonable rate, guidance lead to supervision and pushing on my part. Nevertheless, the students were pleased to belong to this group, though they did not quite see the implied obligation that a superior ability calls

for superior performance. However, I cannot say that the time was wasted. In the time I spent in consultations, I could have probably produced as much by myself. But the students gained an insight into what might be referred to, perhaps a little euphemistically, as frontiers of pharmacy. They saw a new side of pharmacy, which was equal to their intellectual capacity, and they were attracted to the project and thus indirectly to pharmacy, whereas otherwise they might have been alienated by the not always avoidable cookbook approach. This is the positive result and eminently worthwhile.

However, all was not positive. The students expected a course free of obstacles. They were not really prepared for the roadblocks, and to overcome the frustration in such situations was not easy. The student likes to see straight ahead. To face the ups and downs of probing the unknown requires a degree of self-confidence, which is rarely found in an undergraduate. To protect the student from such frustration and yet to have him work on special projects would necessitate using him more as a technician, which is contrary to the ideals of a college education.

The second question I posed: Was it worth it? The answer must be considered from the student's point of view as well as that of the instructor.

From the student's viewpoint, the answer is a mixed one. Although they all confessed that they liked this set-up, actually there was some indifference. The relatively large number of incompleted projects is to me a reflection of insufficient spark. The final reports, required of each subgroup, ranged from excellent to rather poor. Again, I am inclined to blame indifference for the poor reports. Even though experimental data may have been scarce or inconclusive, it is still possible to submit a polished report. Although I discussed the reporting, I set no norm. The report was another expression of the extent of the student's participation. In a few groups, one or two students did most of the work, while the third member remained pretty inactive.

The second part of the second question: Was it worth it *to me?* Definitely not at the time. I sometimes despaired when I failed to locate some members of the section in either of the two laboratories (physical chemistry or pharmacy) or in the library; or when I discovered that between weekly conferences little or nothing was done. To be sure, some of this I expected. But as this type of teaching demanded more of me than the regular laboratory exercises, I subconsciously demanded more of the students. The laboratory section, which performed the regular and tested assignment and which I had going on concurrently, provided comparative relaxation. My assessment of the experiment went from high to low as the semester progressed. Now, having become more detached with the passing of time, I view it more positively. Time is like an extraction process: It separates the desirable from the undesirable. I have mellowed enough to venture into a similar experiment if the opportunity arises. But it would have to be with fewer groups and more carefully selected students. Then in can be rewarding for both parties involved, and, implicitly, can help to strengthen the profession.

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COMMENTS ON THE TEACHING OF PHARMACOGNOSY

ROBERTSON PRATT

Pharmacognosy, possibly more than any other course in the pharmacy curriculum, has been the subject of intense debate for the last decade or two. Major controversies have centered around (1) content and scope of the course, (2) unit value and distribution of didactic and laboratory time assigned to it, (3) proper prerequisites to be taken in preparation for it, (4) ideal placement of the course in the curriculum, i.e., first, second, or later years, and (5) the best system of classification of drugs to be included in the course. There is not complete agreement concerning even such fundamental points as the major objectives of the course.

Different aspects of the subject and its ramifications have been discussed frequently at the Teachers' Conferences held during the annual meetings of the American Association of Colleges of Pharmacy, and many of the discussions have been printed or abstracted in this journal. Blauch and Webster devoted nearly fifteen pages (almost 6 per cent of the total) to discussion of Pharmacognosy in the *Pharmaceutical Curriculum* (1952). This is more space than was given to any other single course. Instruction in pharmacognosy was the topic of the special seminars sponsored jointly by the American Association of Colleges of Pharmacy and the American Foundation for Pharmaceutical Education and held in Salt Lake City in 1953 and in Chicago in 1959. The subject has been considered frequently at meetings of the Plant Science Seminar.

There are numerous reasons why greater diversity of opinion exists concerning the teaching of pharmacognosy than of other courses in the pharmacy curriculum. These differences of opinion stem from the widely divergent professional backgrounds of teachers of the subject; from changes in practices of the pharmaceutical manufacturing industry and of retail pharmacy; and from the growing importance of synthetic medicinals which, in some classes of medicaments, have tended to overshadow products of natural origin; as well as from other factors. However, my purpose is not to discuss the reasons for the divergent views on the subject but rather to discuss one point, i.e., the value of different systems of categorizing natural drugs for presentation to undergraduate students.

Probably everyone will agree that the purpose of classification is to provide a systematic arrangement of items according to some definite scheme, and that the scheme that is chosen should serve a useful purpose. A system that is functional at one time and under one set of circumstances may not be maximally useful at another time or under another set of circumstances. Before the era of abundant synthetic medicinals, there were essentially two classes of pharmaceuticals, viz, the natural products of biological origin and inorganic substances. During that presynthetic drug period, pharmacists prepared many of their own decoctions, tinctures, fluidextracts, etc., and often dispensed crude botanical drugs, and it was important for them to be able to identify quickly the crude materials with which they worked and to detect substitutions or adulterants. It is generally

agreed that during that period the morphologic and/or taxonomic approaches to pharmacognosy and the attendant emphasis on plant histology were very useful. It is also generally agreed that such systems of classification are not maximally useful for students planning to enter retail practice in an era when the pharmacist seldom sees a botanical drug in its crude form after he leaves school and when medical practice is based less on empiricism and more on fundamental knowledge of physiology and pharmacology and of tissue-specific or organ-specific drugs than it was formerly. In the environment of current pharmaceutical and dispensing practice, knowledge of the morphology and the taxonomic relationships of crude drugs serves to broaden the pharmacist's general knowledge and appreciation of the purified items with which he works; but neither morphology nor taxonomy is a useful criterion for primary classification of drugs of natural origin.

The two systems of classification which have attracted most adherents since the demise of the older ones based on morphology and taxonomy are the so-called biochemical system and the therapeutic system. The latter is also sometimes called a physiologic system of classification.

The phrase "biochemical classification of drugs" has been bandied about quite freely by teachers of pharmacognosy in the last decade. The term is a misnomer. What is really meant is "chemical classification." Biochemistry refers to the chemistry of living organisms and of vital processes. It is concerned largely with sequential events—with processes that sometimes are peculiar to living systems but that none the less consist of a series of individual chemical reactions that occur stepwise or sometimes concurrently.

Knowledge of plant biochemistry, particularly with reference to most of the plant compounds that are therapeutically active or pharmaceutically significant, is not yet sufficiently advanced to permit classification of drug principles in terms of the pathways of their biosynthesis and degradation or of the processes of plant metabolism into which they enter, and it is doubtful that such a classification would have practical value for the pharmacist if it could be devised. The so-called biochemical system of classification is in reality simply a chemical system in which many natural drugs are classified according to the chemical class to which the major active constituent belongs, i.e., alkaloid, glycoside, volatile oil, resin, gum, etc. Although one often hears the term "biochemical compound," there seems to be little justification for it. A chemical, whether it be of natural origin or a product of the laboratory, is still a chemical. It may have a biologic function in either plant or animal cells; but it is, none the less, a chemical and not a *bio*chemical.

In justification of their position, proponents of the chemical system of classification seek support from the fact that the isolated active principles, instead of extracts or the whole crude material, are preferred in current medical and pharmaceutical practice. But this argument is unimpressive. One of the goals in pharmacy education is to enable students to understand structure-action relationships of drugs. The chemical classification does not foster or develop interest in or understanding of such relationships because not all compounds of a given chemical class, or even subclass, have related biologic effects or medicinal uses. Tables I and II are abridged tabulations of the grouping of some representative drugs according to two recently proposed chemical classifications.

One cannot fail to be impressed by the fact that in Table I there are grouped together drugs which have no relation to each other in terms of biologic effects

or of practical application. In one group we find an antimalarial, a cardiac depressant, and a CNS stimulant; in another, expectorants, an astringent, a skeletal muscle relaxant, and a CNS depressant; in another, a CNS stimulant, antaraxic and hypotensive agent, a parasympathomimetic, and an oxytocic; etc. If one considers the lactone subgroup of glycosides, a flavoring agent (Coumarin NF), an anthelmintic (Santonin NF), and an irritant vesicant (Cantharides NF) are discussed together. Similar lack of consistency and of logic is found in the other chemical groups also.

TABLE I. SOME ALKALOIDAL DRUGS GROUPED ACCORDING TO A CHEMICAL CLASSIFICATION

Group	Drugs	
Pyridine-piperidine	Areca NF	Anthelmintic
	Lobelia NF	Emetic, expectorant
	Conium	Antispasmodic, sedative anodyne
Tropane	Belladonna (USP and NF products)	Parasympatholytic
	Hyoscyamus NF	
	Stramonium NF	
	Coca	Local anesthetic
Quinoline group	Quinine (USP and NF products)	Antimalarial
	Quinidine (USP and NF products)	Cardiac depressant
	*Nux Vomica NF	CNS stimulant
Isoquinoline group	Ipecac USP	Emetic, expectorant
	Hydrastis NF	Bitter, stomachic, astringent
	Sanguinaria NF	Emetic, expectorant
	Tubocurarine USP	Skeletal muscle relaxant
	**Opium	CNS depressant
Indole	*Nux Vomica NF	CNS stimulant
	Rauwolfia	Ataraxic, hypotensive
	Physostigmine	Parasympathomimetic
	Ergot NF	Oxytocic
Steroid	Veratrum Viride NF	Hypotensive
	Aconite NF	Analgesic, cardiac sedative
	Larkspur	Parasiticide
Alkaloidal Amines	Ephedrine NF	Sympathomimetic
	Colchicum Seed NF	Analgetic

* Strychnine and brucine, the chief alkaloids of Nux Vomica, contain both quinoline and indole structures. Some authors place the drug in one group, some in the other.

** Actually, the most important alkaloids of opium, i.e., morphine and codeine, have a phenanthrene nucleus. But because the majority of the opium alkaloids have the isoquinoline structure, several authors have placed opium in this group.

TABLE II. SOME REPRESENTATIVE DRUGS GROUPED ACCORDING TO ONE PROPOSED CHEMICAL CLASSIFICATION

Group	Drugs	
Carbohydrate	Glucose	Cotton
	Lactose	Acacia
	Streptomycin	Agar
	Neomycin	Heparin
	Dextran	
Fatty Acid	Linseed Oil	Lecithins
	Sesame Oil	Spermaceti
	Olive Oil	Castor Oil
	Lard	Erythromycin
Steroid	Wool Fat	Digitalis
	D Vitamins	Sarsaparilla
	Adrenal Cortex Hormones	
Phenylpropide	Hamamelis Water	Vanilla
	Bitter Almond Oil	Peruvian Balsam
	Salicylic Acid	Podophyllum
Proteid (Peptides)	Pantothenic Acid	Pituitary
	Penicillin	Corticotropin
	Chloramphenicol	

In addition, there are several drugs which cannot be properly placed in any of the established subgroups of the major chemical classes and, therefore, are lumped together as Miscellaneous Alkaloids, or as Other Glycosides, or as Other Carbohydrate Products, or as Miscellaneous Volatile Oil-Containing Drugs, etc. And finally, the system breaks down completely with respect to several groups of very important drugs, and these drugs are grouped in terms of origin, e.g., Endocrine Products (or Hormones), Blood Derivatives, Bacterial Products, or in terms of function or use, e.g., Antibiotics, Vitamins, Allergens, Immunizing Biologicals, Products Used as Toxicants (Pesticides). Certainly it cannot be maintained that Endocrine Products, Antibiotics, or any of the other groups just mentioned constitute chemical classes. Thus proponents of the chemical classification are forced, by the very nature of the materials with which they deal, to resort to some other system of classification for approximately half of the major groups of products to be discussed in the pharmacognosy course.

Except for a few drugs used as pharmaceutic aids, e.g., coloring agents, filtering agents, etc., it is the response that a drug can evoke in living tissues and organs that determines its medicinal use. Therefore, it seems important to emphasize the biologic properties of the drugs. It seems far more important for the undergraduate student and the practicing pharmacist to associate in his mind drugs that have similar biologic effects than to associate all lactone-type glycosides, or quinoline alkaloids, or isoquinoline alkaloids, or phenol volatile oils, ketone volatile oils, or carbohydrates, etc.

The grouping shown in Table II provides some equally strange bedfellows. The antibiotics, streptomycin and neomycin, are sandwiched between lactose

and dextran, and all of these are discussed in the same general group with other agents which are not related to them, or even to each other, by any logical ties, in terms of factors that make them significant in medical and pharmaceutical practice. Thus there is brought together in one division a therapeutically and pharmaceutically (and one might even add, chemically) most heterogeneous group of drugs. In the fatty acid group there are discussed together lecithins, spermaceti, castor oil, and erythromycin. In the proteid group, we find pantothenic acid, penicillin, and corticotropin. The other groups contain companions which are equally unrelated and absurd in terms of the principal reason that they are considered at all in pharmacognosy, namely, their ultimate practical use in therapeutics or in formulation.

Sometimes it is claimed that the chemical system of classification is the most desirable because it is important for the pharmacist, in his role in compounding drugs, to be familiar with incompatibilities. This argument might have had more validity in the past when the art and skill of compounding were major aspects of the pharmacist's service. But changes in the basic pattern of pharmacy have been such that the pharmaceutical manufacturing industry has taken over much of the work that was formerly left to the retail pharmacist and now compounding has become one of the minor functions of the retail pharmacist and probably will continue to decrease in importance. Entirely apart from other considerations, one cannot but question the validity of a chemical system which lumps together such chemically unrelated items as lactose and streptomycin or pantothenic acid and penicillin.

Certainly the chemistry of the drugs should be considered in pharmacognosy, but it is putting the cart before the horse to make an idol of the chemistry. The chemical consideration, in my opinion, should be subordinate to the purpose for which the drugs are used. Chemistry should be considered as a means of explaining the how and why of what the drugs do or of the processing and extracting methods, not as an end in itself, with the use, which is the only feature that gives the drugs purpose, being incidental.

None of the above remarks is meant to minimize the importance of knowing the chemistry of each of the drugs. The question is one of emphasis and of providing maximum practical and utilitarian value along with a sound education. Today the pharmacist dispenses pharmacologic agents—not chemicals. Knowledge of pharmacology is part of the basic core of medical practice. To render maximum professional service it is essential that the pharmacist have a good comprehension of the various therapeutic classes of drugs and of their biologic significance. The course in pharmacognosy should be an important building block in the biologic sequence that forms the foundation for pharmacology.

It is important for the pharmacist to know the chemical classes to which the drugs with which he works belong, but this is secondary to knowing the practical applications of the drugs and understanding the fundamental biologic bases for the applications. For example, such diverse applications as flavoring agent, anthelmintic, and irritant vesicant do not stem fundamentally from the fact that coumarin, santonin, and cantharidin, respectively, are lactonic glycosides. There are numerous flavoring agents, anthelmintics, and irritants that belong in numerous other chemical categories, and it seems much more logical to discuss all of the flavoring agents together, all of the anthelmintics together, and all of the irritants together. This has the added advantage of permitting the teacher to point out the diverse chemical classes of compounds which may exert similar

effects and that the same or similar effects may be brought about by different types of chemical stimuli, thus giving depth as well as breadth to the instruction and strengthening the concepts of structure-action relationships. If the physiology course precedes or is concurrent with the one in pharmacognosy, there is a grand opportunity to relate these effects to the basic physiology that is involved. But it is not essential that the physiology course precede pharmacognosy.

Again, the action of streptomycin, erythromycin, and penicillin as antibiotics does not stem from the fact that they may, in some instances by tenuous connections, be considered as related to lactose, fatty acids, and pantothenic acid, respectively. How much more logical it would be to consider all of the antibiotics together and then to point out the different chemical types that may exert such action and to relate the different structures to the specific biochemical processes with which they interfere in the sensitive organisms!

Similarly, quinine is not a useful drug in auricular fibrillation because it has a quinoline structure or even because it is an alkaloid. It is a useful drug because it has a specific biologic effect. Other drugs with very different chemical structures have similar action and similar therapeutic use. It seems more important for the pharmacist to associate quinidine with other drugs that exert similar cardiac action and to understand the applications and limitations of each than to associate it with drugs like strychnine and angostura bark which contain quinoline alkaloids but are entirely unrelated in biologic effects and therapeutic applications.

There are other reasons also for preferring a therapeutic or a therapeutic-physiologic classification to one based only on chemistry. No matter which of the systems is used, some misfits—drugs which it is difficult to place—are encountered. Some of the numerous difficulties and inconsistencies that arise when a chemical system is employed have already been pointed out above. The therapeutic or therapeutic-physiologic basis of classification gives rise to fewer misfits. They have real teaching value because they give meaning to the concept of side effects. Such effects then become not merely items to be learned by rote but rather comprehensible biologic entities, the basis of which can be more easily understood when studied comparatively with other drugs that exert effects on the same muscle, nerve, organ, or tissue system.

None of the comments above should be construed as negating or even minimizing the importance of botany and of chemistry in teaching pharmacognosy. The point under consideration is solely the question of the most useful system of grouping drugs in the basic pharmacognosy course. It seems much more practical, and also to have greater educational value, to make the primary grouping according to a system that takes cognizance of the role that biologic action has in determining medicinal use rather than to make the primary grouping in terms of chemical components which often have little relationship to the purpose for which the drug is used in medicinal practice and which, in any case, results in a system of classification that accommodates only about half of the groups of drugs that need to be discussed. This is especially true in view of the increasing role of the pharmacist as drug consultant to the physician. Within each of the primary classes, one can consider subclasses, members of which are grouped on the basis of chemical relationships. For example, in considering the large group of drugs used for effects on the skin and mucous membranes there would be two subgroups. The first would include those drugs which have a physical basis of action, i.e., the effect does not depend on chemical interaction

of constituents of the drug with components of the organic system being treated. The second subgroup would include those drugs which exert the desired effect because constituents of the drug interact chemically with tissue components. In the first subgroup are the lipids (fixed oils, fats, and waxes) and the carbohydrate derivatives (gums and mucilages) used as emollients and demulcents. In the second subgroup are the tannins, used as astringents, and the tars, resins, gum-resins, oleoresins, and balsams used as irritants, the volatile oils used as irritants, etc. Similar appropriate outlines can be made easily for the other major therapeutic classes of natural products. Such a plan has the obvious advantage of encompassing in a single classification the merits of both the therapeutic-physiologic and the chemical systems without the attendant difficulties and inconsistencies inherent in a system which uses chemical relationship as the prime feature in grouping the drugs.

When a therapeutic or physiologic system is employed, related synthetic medicinals which the instructor may deem it important to discuss can be treated more logically because they are considered in context, as it were, i.e., in comparison with not just one or two but with *all* natural constituents that are used in medical practice for the same general effects. While pointing out the chemical similarities and differences among the several agents, both natural and synthetic, the instructor can paint a coherent picture of the graded responses and altered or reduced side effects of the different agents and show how these are associated with changes in molecular structure. This provides an approach which is more useful to the student in other courses, such as pharmacology, and is more useful to him, following graduation, in his discussions and consultations with his medical conferees. It was pointed out before that medical practice is based on the prescribing of pharmacologic agents—not chemical compounds.

Perhaps a fundamental question is "In the undergraduate program, are we educating and training future pharmacognosists or future chemists or future pharmacists?" Or, to put it in other words, "Do we consider studying pharmacognosy simply as an academic exercise the most desirable and useful objective of our undergraduate students or do we wish the subject to become a practical part of their professional activity, as it was in the presynthetic medicinal era?" Changes in pharmaceutical manufacturing and distribution practices and in medical practice have rendered obsolete the former morphologic and taxonomic approach and have minimized the importance of the chemical approach. But the subject can be restored to its former vitally useful place in retail pharmacy if approached from the therapeutic or the physiologic points of view.

The broadening and cultural value of a good course in pharmacognosy cannot logically be denied, no matter from which point of view it is taught. But, in the present crowded curricula in pharmacy, is one justified in teaching any applied course in any manner except the one that squeezes from the subject as much utilitarian value as well as cultural enrichment as possible?

I do not look upon pharmacognosy as an end in itself, but rather as a "tool course." Our aim is to use pharmacognosy as a unifying subject that serves to cement the material of preceding and succeeding courses in biologic subjects into a firm stepping stone to pharmacology and a comprehension of the basis for the practical uses of the natural drugs and their synthetic counterparts or substitutes. This approach to pharmacognosy serves best the student's academic development and his practical needs after graduation.

THE CONSULTANT PHARMACIST

L. WAIT RISING

Much has been said about the role of the pharmacist as a consultant on pharmaceuticals to the physician and other practitioners of the healing arts. The pharmacist, when assaying his position as a member of the public health team, nearly always lists the furnishing of information about drugs as one of his important functions. The pharmacy professor, when discussing the lengthened educational program for the profession, believes that one of the strongest favorable arguments for it is the resulting improved scientific background as a basis for this type of consulting service.

No one can deny that the idea is a good one. The pharmacist should be the local center of information about drug products. There is considerable question, however, concerning the areas to be included and the extent to which the service is now being used. Doubt also exists in the minds of many practicing pharmacists that the physician looks upon his retail colleague as a worthwhile source of help when problems in the basic sciences arise, or that the pharmacist is especially interested in being consulted in these areas. Or, for that matter, that he is especially qualified.

Discussions designed to clarify the situation are usually based on opinion and/or supposition. Few attempts have been made to determine by field studies how much dependence the doctor does place on his pharmacist for information, what kind he asks for, and how frequently.

In any debate published evidence from reliable sources is helpful in proving points. There is practically none available in the matter of the status of the pharmacist as a consultant to the physician. The *General Report of the Pharmaceutical Survey 1946-49* devotes a few pages to "an analysis of the general knowledge that a pharmacist should have regarding pharmaceutical products as indicated by information requested by members of the medical profession and questions asked by customers." According to the survey, "preliminary efforts [to gather this information] indicated that the project was more difficult than first appeared." All that was reported, therefore, was (1) a list of 198 questions asked by physicians in various parts of the country, and (2) an analysis of the replies to 273 questionnaires returned from practicing pharmacists which asked them to "indicate five questions frequently asked you by physicians."

No important frequency patterns appear in the answers to the questionnaires or in the 198 questions. Among the most numerous calls were requests for prices, dosage, product identification, product availability, and strength of active ingredients. There were questions concerning therapeutic activity, contra-indications, and other points that suggest the doctor's faith in the basic or biological science knowledge of his pharmacist. These were not regular enough to develop a pattern of general application. It was thus obvious that this confidence was bestowed on only a very few pharmacists.

This study was made over a decade ago. Has the situation changed? Is the physician of 1959 making more use of the training and knowledge

of his pharmacist than did his colleagues of 1949? One might reason that he is. Pharmacy has had ten years in which to implement and strengthen its consulting service.

In order to attempt an answer, a short study of what the doctors were now asking of Seattle pharmacists was made. Twenty-six local pharmacies, scattered over the entire metropolitan area, serving 600,000 people and several hundred physicians, were asked to record all the requests for information made by physicians for a ten-day period. At best the poll was a matter of random selection, and its success was dependent upon the faithful performance of the pharmacists involved. But it was a start to what it is hoped will, through experience and cooperation with other colleges of pharmacy, develop into an effective system for reliably reporting the nationwide use being made by physicians of the pharmacist as a consultant on pharmaceuticals.

The results, though indeterminate and statistically weak, are nevertheless interesting and illuminating. For one thing, only 159 questions were reported by the twenty-six pharmacies for the ten-day period. These have been divided into ten pharmaceutical categories, to which has been added an eleventh or miscellaneous catchall for the nonpharmaceutical questions. The results are shown in Table I.

A comparison of the data in Table I with that in the *General Report of the Pharmaceutical Survey 1946-1949* does not show any deeply significant differences. The doctor has not, in the intervening decade, become more dependent on the pharmacist for technical information or help in making his prescribing decisions.

Viewed by itself, the data in this study make evident the following:

1. On the average, each of the twenty-six pharmacies was asked less than one question a day.

TABLE I.

Question Category	Number of Questions	Frequency %	Frequency Ratio
1. Dosage	25	15.7	1 out of 6 questions asked
2. Strength of active ingredients	25	15.7	1 out of 6 questions asked
3. Therapeutic suitability or contraindications	23	14.5	1 out of 7 questions asked
4. Product identification	22	13.8	1 out of 7 questions asked
5. Price	17	10.7	1 out of 9 questions asked
6. Forms available	16	10.0	1 out of 10 questions asked
7. Miscellaneous	11	7.0	1 out of 14 questions asked
8. Product comparison or differentiation	8	5.0	1 out of 20 questions asked
9. Substitute products	6	3.8	1 out of 25 questions asked
10. Package size	4	2.5	1 out of 40 questions asked
11. Ingredients (What is in it?)	2	1.2	1 out of 80 questions asked

2. Scarcely half of the questions required a four or five year college training in pharmacy to answer.
3. On the average, then, each pharmacy would have a question requiring college training for answering only every other day. Compare this with the average physician seeing thirty-five to fifty patients a day where each one makes use of much of his medical training.
4. There is still a wide gap between the education for pharmacy and its use in the practice of pharmacy. One might ask who is at fault. Is the education impractical; are the practitioners going in the wrong direction; or are both groups guilty of missing the boat?

Of course, before too many conclusions are drawn it must be realized that the evidence summarized in Table I admittedly is weak. But it is a straw in the wind which suggests that one of our strongest claims to professional status could be foundationed in sand.

Perhaps we are barking up the wrong tree when we urge the wearing of the consultant's mantle by the pharmacist. Do we need this sort of expertism in retail practice? Does the physician really feel deficient and in need of help in the areas where we want the pharmacist to consult? And, if he does feel incompetent, is there ever a resultant inclination to call on his pharmacist for assistance?

We do know that the busy physician has little time to digest the information given him by medical service representatives about new drugs, or to study properly reports in medical journals evaluating them. Nor does memory always serve him well when he is confronted with the multiple-choice problems in prescribing. Who better to consult in these situations than his pharmacist?

People are consulted because of recognized superior knowledge or experience in areas where other people feel their own knowledge or experience is inadequate. Logically the pharmacist should be expected to stand out in the area of medical materials. His college of pharmacy was established to lay the ground work for superiority. His curriculum was designed to fulfill that objective. His faculty bent their energies to that end. His diploma and certificate of registration give visible testimony to his knowledge. His professional conduct after graduation should complete the proof of competence.

If in the face of all this evidence he is still not consulted regularly by the physician, does it mean that the pharmacist is only a technician? Does it mean that faculty and practitioner alike have failed to understand and implement one of the important potentials for service which could exist in pharmacy and which could grow from the expanded educational program? A pharmacy giving professional service to the other members of the public health team, at a level which reflects the quality of a sound five year college program in basic chemical and biological sciences and their utilization, will not be easily reduced to technician status. Are we failing to bring the services of pharmacy in line with its education? Or is our plan for education poorly conceived to meet the needs of pharmacy?

While we are asking questions, here are several others which are provocative:

1. What does our pharmacist-expert know which will really be of help to the physician?
2. What does he do with this information or skill?
3. How does he keep his information current?
4. Is he sufficiently interested in the professional aspects of practice to work at becoming a consultant?
5. What categories of people consider him sufficiently well-informed to be consulted?
6. What categories of people do not credit him with knowledge beyond their own; hence, do not consider him worth consulting?
7. What are the factors which create the faith in pharmacists as consultants for some and deny it to others?
8. Since it is obvious that consultants survive only if they fill a need, can we conclude that there is no need?

It is hoped that this sketchy beginning will be the start of a substantial program for collecting reliable data on the position of the pharmacist as an information center, a program which will make use of the facilities of all colleges of pharmacy and other interested groups. Research in this area is just as significant to the welfare of the profession as is the chemical laboratory type. It holds greater potential for bringing teaching and practice together. Certainly the questions raised in this paper deserve answers based on facts rather than opinions.

A durable world peace must of necessity rest upon a cooperative world. But cooperation among nations is fostered most advantageously through the development of wise systems of education in all nations and the free dissemination of the results of the discoveries and advances in the physical and medical sciences, in technology, and in all branches of learning.

Edward H. Kraus, Am. J. Pharm. Ed., 9, 546 (1945)

THE GROWING THREAT TO PROFESSIONALISM

PAUL A. DOYLE

Some months ago *The American Druggist* conducted a survey on the ever-increasing trend in the pharmaceutical field to "big-ticket" merchandise. A "big-ticket" item was defined as a product, sold by a retail outlet, which "sells at a higher price . . . and produces higher margins . . . than do the items which that type of outlet ordinarily handles." Of the drugstores surveyed 63.7 per cent were found to stock hosiery; 40.8 per cent stocked electrical items; 18.4 per cent carried sporting goods; and 18.3 per cent carried garden supplies. Listed among other items which more and more drugstores are selling were: portable radios, phonograph records, TV and radio tubes, costume jewelry, toys, and adult games (1).

Just recently, one of the largest and most respected of the local New York City pharmaceutical associations featured a lead article in its monthly magazine which lavishly praised the present tendency toward "big-ticket" merchandise. This new trend in pharmacy was considered as valid and necessary retaliation against the supermarkets and other nondrug outlets. It is not only justifiable but desirable, stated this article, that the drugstore sell sporting goods and household appliances as well as hearing aids, abdominal belts, and wheel chairs. Since hearing aids, abdominal belts, and the like do concern health, perhaps some slight case might be made out for the pharmacist selling such merchandise even though these products are not associated with his professional duties; but, when the selling of household appliances and sporting goods is considered by a large pharmaceutical association as proper and appropriate, we can certainly pause and consider if something is not amiss.

LOSS OF TRADE

It is certain that pharmacists have lost customers and trade to the supermarkets. Nondrug outlets have been constantly increasing their stock of health and beauty aids. It seems improbable that legislation can be enacted to stop this situation since competition and trade outlets are at stake in this question, and no manufacturer of dentrifices, cosmetics, or similar items can be legally prevented from choosing his distributors.

PHARMACIST SOMEWHAT RESPONSIBLE

Many people feel that the pharmacist by selling nonpharmaceutical items has brought this situation on himself. As George Beal (2) has written:

> During the past fifty years a very large part of the retail pharmaceutical trade has been devoted to the promotion of wholly unrelated miscellaneous lines, each added as a potential profit maker. Miscellaneous manufacturers and wholesale distributors have encouraged this, they having in mind the long hours during which pharmacies remain open, thus extending the time during which their products are available to the casual shopper homeward bound from the movies or the careless shopper in the residential neighborhood. Even all-night lunch-rooms have closed because they could not meet the competition of the lunch features of the drugstore soda fountain. And, to a large extent overlooking the fact that they were first of all guilty of encroaching on the fields of other retail businesses, pharmacists, encouraged by many of their editorial

writers and association leaders, vocally and bitterly resent advances made by other retail outlets in adding to their stock in trade profitable items from the drug business that do not require too much professional knowledge for their distribution. Pharmacists are encouraged by detail men and experts on store management to put even numerous pharmaceutical miscellany on a self service basis, their only professional contribution being the wrapping of the package and ringing the cash register. Then they go to the state capital and prate about their professional responsibility, in order to prevent another respectable retail outlet from doing the same thing. To many people it seems incomprehensible that a large part of pharmaceutical curriculum is not devoted to training in methods of business administration.

NOT A FATAL SITUATION

That the loss of formerly exclusive drugstore products is not fatal has been frequently pointed out. Dr. John N. McDonnell (3) has maintained:

> Contrary to popular pharmaceutical belief many pharmacists have found that they can compete successfully on a price basis on the popular items. They can fight the patent medicine stores, "pine boards" and super-markets, and by emphasizing their individuality and their service, and by giving fair prices, they can hold the business of their neighborhood. Naturally, they have to watch carefully and rigidly control their service costs, such as for delivery, charge accounts, etc. These are costly services which are *not* expected of their grocery and super-market competitor.

PUBLIC CONTACT

As has been repeated constantly by many pharmaceutical educators, the public forms its opinions of pharmacy through contacts with the corner drugstore. If the public is able to distinguish between a pharmacy and a supermarket only on the basis of groceries, the professional rating of pharmacy will decline. The public's attitude in such a situation could even reduce the effectiveness of the five year program. The five year program is designed in part to furnish the pharmacist with a more general academic education in order that he can take more active leadership in public health and public welfare service; yet, the trend to "big-ticket" merchandise would work against such leadership since this trend lessens the public's respect for the pharmacist.

LOSS OF IDENTITY

If the pharmacist is going to sell almost anything and everything, he is going to lose his identity. After reading about "big-ticket" merchandising in pharmacy, it is quite possible to concur with a statement made in 1947 by the School of Pharmacy faculty of the University of Maryland (4):

> The potentialities of these seemingly unlimited additions to pharmaceutical services are shocking. Hardware and grocery items—even automobile servicing—are by no means inconceivable additions. This hodgepodge of merchandise and services carries with it a real threat to the continued existence of the drug store itself. Other businesses —confectionery stores, tobacco stores, cosmetic stores, grocery stores, five-and-ten-cent stores, super markets—hungry for sales volume, will no doubt start, if they have not already done so, to add drug items to their stocks in trade.
>
> The conscientious pharmacist is concerned over these forebodings and is irked by present conditions. He earnestly desires to devote all of his working time to the practice of the profession for which he has been educated and trained; he feels that the sale of intoxicating liquors and the introduction into many drug stores of gambling devices have brought about a loss in the cleanliness and dignity that are indispensable to the proper conduct of any type of medical service.

Since bridge tables, TV snack tables, wall mirrors, etc. are now sold in some pharmacies, it is certainly not impossible or difficult to envision "automobile servicing."

OPPOSE "BIG-TICKET" MERCHANDISING

As educators of future pharmacists we must vehemently oppose the present trends to "big-ticket" merchandising. It is an affront to a pharmacist's education to have him sell hardware, furniture, and sporting goods. As educators of future pharmacists, we must take every legitimate opportunity in our lectures, in conferences, and in personal contacts with our students to emphasize the professionalism of pharmacy and the danger of "big-ticket" trends. We must convince our students of the loss of professional esteem, dignity, and significance that they will face by selling department store products. We must bring them to consider always the words of Rudolph Kuever (5).

> The future progress of pharmacy will depend largely on the success of the colleges of pharmacy in preparing men and women to deliver service on a professional basis rather than on the basis of commercial achievement.

We must be constantly vigilant in the struggle for professionalism. We must keep professionalism continuously in our minds and in the minds of our students. "Big-ticket" merchandising is a frightful threat to professionalism.

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(4) Elliott, Edward C., "The General Report of the Pharmaceutical Survey 1946-49," American Council on Education, Washington, D.C., 1950, p. 84.

(5) Kuever, Rudolph A., *Am. J. Pharm. Ed.*, 5, 440 (1941).

I believe that the doctor of the future will, more and more, look to the well-trained pharmacist for many of the types of technical service needed for adequate diagnosis and treatment, and especially for advice and suggestion in that type of service which is peculiarly within the pharmacist's domain, the selection of medicaments and the determination of dosage.

John A. Goode, Am. J. Pharm. Ed., 9, 7 (1945)

A LOW-COST TABLET DISINTEGRATION APPARATUS FOR THE UNDERGRADUATE PHARMACEUTICAL PREPARATIONS LABORATORY

RICHARD F. CHILDS AND JACK R. COLE

Currently the dosage form "Compressed Tablet" or its coated variations are dispensed most frequently in pharmaceutical practice. "As recently as 1939, 75 per cent to 80 per cent of all prescriptions were extemporaneously compounded by pharmacists. Today the reverse is true: 80 per cent to 90 per cent are written for prefabricated articles, and, in some sections of the country, the proportion is said to be over 95 per cent." (1)

The graduate student in pharmacy is usually exposed to manufacturing processes such as tablet compression, hardness testing, and tablet disintegration. However, it was evident that the undergraduate pharmacy student needed more laboratory contact with the compressed tablet dosage form. It was considered desirable to supply a tablet disintegrator for every pair of students so that several experiments could be conducted during a three hour laboratory period.

PART I

A low-cost tablet disintegration apparatus to fulfill this need has been devised. The cost of this apparatus is less than $1.00. A Hankscraft Company flashlight battery-driven display card oscillator (Pat. No. 2598954, Reedsburg, Wis. (used equipment supplied by local pharmacists)) is the primary piece of equipment. Two flexible copper wire loops were soldered to the oscillator's pivot shaft. Two plastic prescription vials, the closed end removed, were fitted with lengths of waterproof trout line, and the ends of the line tied to the copper wire loops. The plastic containers chosen were those that matched closely the size recommended in the USP XIV, p. 700, "Apparatus for Disintegration Tests for Tablets." Small discs of 10-mesh No. 23 W. & M. gauge woven stainless-steel wire cloth replaced the removed end of the plastic vial. Two additional wire loops were affixed to the Hankscraft oscillator to prevent the vials from striking one another when in motion, and to direct each vial into separate 600 ml. beakers.

The apparatus was suitably clamped to a ring stand, and the two vials were permitted to dip into their respective beakers. One beaker contained Gastric Fluid, Simulated TS (USP), the other contained Intestinal Fluid, Simulated, TS (USP), both at the liquid levels recommended in the USP XV. The apparatus was allowed to oscillate, thereby raising and lowering the vials into the solutions. When the two vials did not move an equal distance, the position of the copper loops soldered to the pivot shaft was adjusted. The length of the stroke is less than that of the official equipment, i.e., 1.5-2.5 cm. as compared with the official 5-6 cm., but the number of cycles per minute was greater: approximately sixty complete cycles per minute for this apparatus as compared with thirty for the official disintegrator.

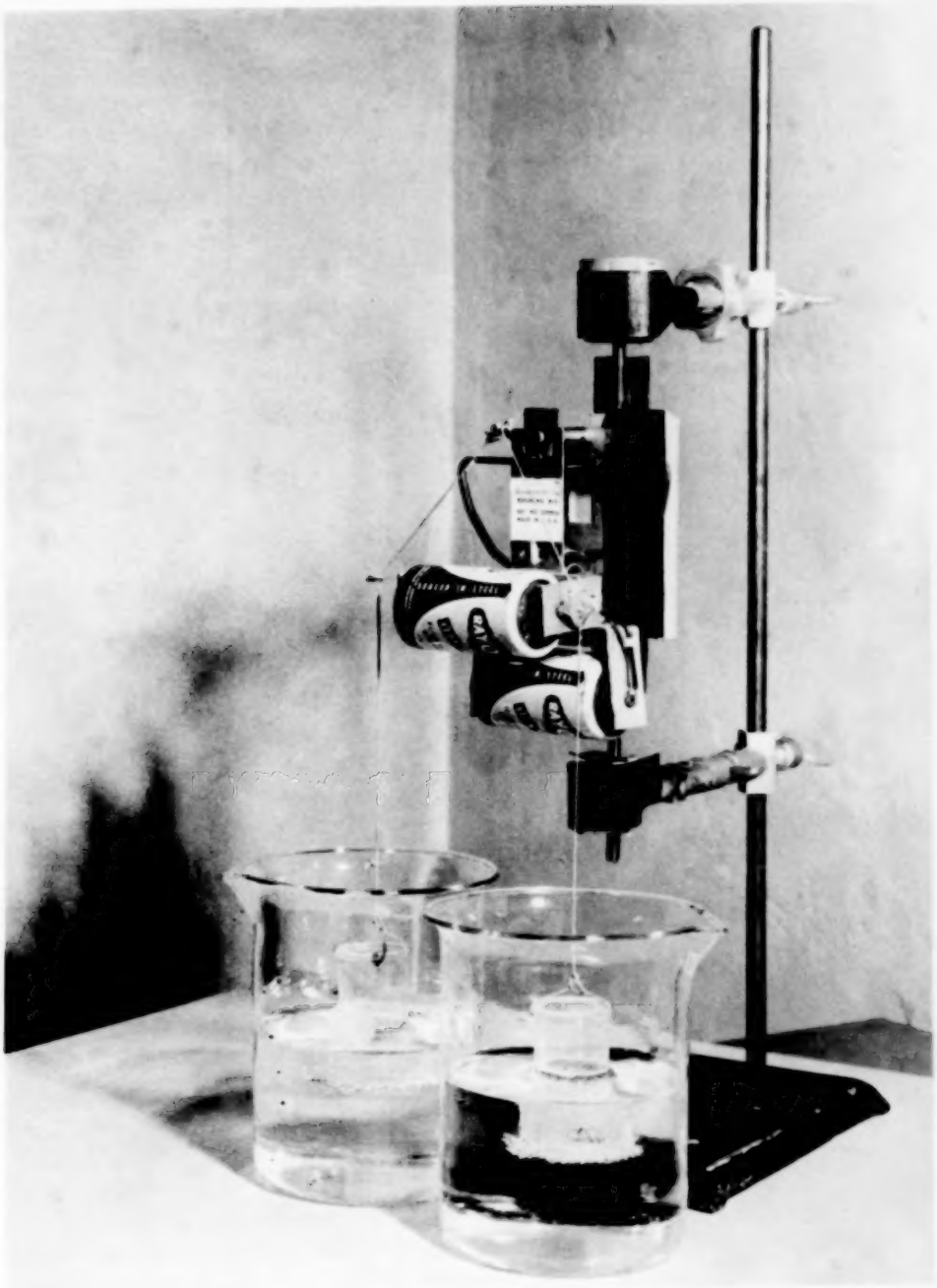

FIG. 1. TABLET AT BEGINNING OF DISINTEGRATION TIME TEST

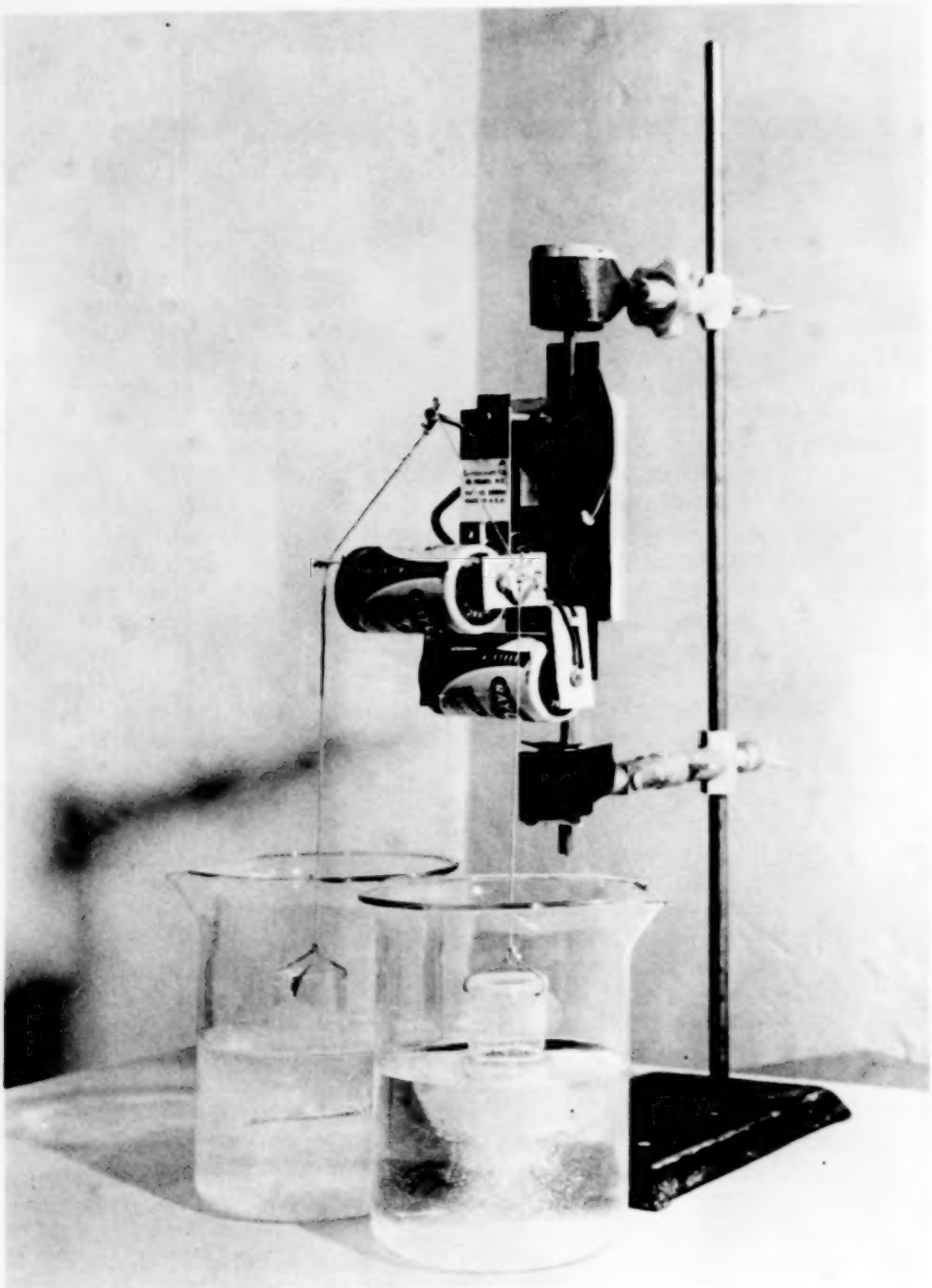

FIG. 2. TABLET DURING DISINTEGRATION TIME TEST

It was possible for each pair of students to determine the relative disintegration time of about five types of tablets during a three-hour laboratory period. The students were given two tablets of each type of product, and one tablet was disintegrated in each of the simulated fluids. The disintegration began with each solution at 37.5°C.

TABLE I. TIME IN SECONDS TO DISINTEGRATE SAMPLE TABLETS

	Calcium Lactate #324 Lilly 5 grains		Bufferin 5 grains		Aspirin Bayer 5 grains		U. of A. Mfg. Lab. Aspirin 5 grains	
Fluid	*Gast.*	*Intest.*	*Gast.*	*Intest.*	*Gast.*	*Intest.*	*Gast.*	*Intest.*
Average Seconds	**452**	**554**	**43**	**38**	**9**	**11**	**12**	**16**

TABLE II. TIME IN SECONDS TO DISINTEGRATE STUDENT PREPARED CARMINE + LACTOSE TT

Class	**Sophomore**	**Senior**
Fluid	Water	Water
Average Seconds	305	10

PART II

Timed disintegration tablets were allowed to disintegrate overnight or longer to demonstrate the stages of distintegration. The students noted that this type of tablet dissolved most rapidly at its equator, and that often thin films floated from the tablet's surface, etc.

The timed disintegration tablets used as laboratory demonstrations were:

1. Potassium chloride enseals.
2. Hemochromin with "B" Complex and Vitamin C.
3. Potassium Chloride Emplets, 5 gr.
4. Ecotrin, 5 gr.
5. Polaramine 6 mg. (Repetab).

It was believed that the students gained a better appreciation of the dosage form "Compressed Tablets." The student should readily grasp the significance of the manufacturing skill that is needed to insure reproducible disintegrating times from batch to batch. In Table II note the wide variation of disintegrating times for the sophomore and the senior student prepared tablet triturates.

This laboratory experience can also be of assistance in understanding lecture discussions on topics such as tablet compression pressures vs. tablet disintegration times.

This low-cost apparatus now makes it possible for all undergraduate pharmacy students to appreciate the dosage form "Compressed Tablet."

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TESTING: A CRITICAL EVALUATION

FRED B. GABLE

Presently in our society almost every individual is tested from the day he is born, if not before, to the day he dies, if not afterward. He is given a battery of tests in his nursery school, elementary school, high school, and college. He is tested before and after his induction into the armed forces, before and after employment, before marriage, before driving an automobile, and on and on to the point that his life's work is test determined. Thus those individuals who construct various tests play most important roles in establishing the social position, reputation, success or failure of a person (1).

The art of testing is a science that concerns all of us. We are interested in tests administered to students applying for admittance to schools of pharmacy, in tests administered to students in a school of pharmacy, and in those examinations a graduate of pharmacy must take in order to practice in a particular state.

Good measurement techniques provide the necessary foundation for sound evaluation. In dealing with educational "measurement" one should keep in mind that such so-called measurement is in reality an evaluation. In order to measure something a unit of expression is necessary. Once a unit is obtained it should have a true zero point which represents "just none" of the quality in question. Educational measurement will never have a true zero point (2).

In 1954, Dr. John W. Paige, Chief of the Bureau of Professional Examination of the New York State Education Department stated, ". . . I feel that the perfect examination will never be devised. Measuring the accomplishments of the human mind is too difficult a program for mortal man." It is a well-known fact that perfection in the measurement of intelligence is not likely. It must be kept in mind that the primary concern of measurement should be for an understanding of the entire field of knowledge rather than with statistical manipulations. In achievement testing the correct number of answers is related to the intelligence of the subject, the quality of the teaching process, and the method of studying and learning. It cannot be overemphasized that measurement at best provides only information and should not in any way be interpreted as providing judgment.

The primary function of any evaluation procedure is to determine to what extent students have achieved the objectives of the instruction concerned. The process of measurement will always be secondary to that of carefully defining the objectives. However, no matter how much care is exerted in developing improved procedures for measuring, the need to interpret results properly will never be eliminated.

Schools of pharmacy considering applicants to their institutions have at their disposal secondary school records of the individuals concerned. These records result from the many tests administered to high school students by an array of qualified, certified educators in our school systems. A school of pharmacy may elect to administer to applicants various entrance examinations as well. Such entrance examinations are carefully selected from

those made available by testing agencies and universities. In the near future, schools of pharmacy will have for evaluation academic transcripts of the applicant's ability as demonstrated during a preprofessional year in college as well as his secondary school records.

Once accepted as a pharmacy student the individual will be administered many other examinations by the faculty of the institution during his course of study. Such tests will determine when students study, what they study, and how they study. Effectively constructed tests may motivate students to develop good study habits and direct their activities toward the achievement of desired goals. The test maker must decide whether he will use essay test questions or short-answer objective items. Both types can be used to evaluate pupil achievement. The essay test is easier to prepare and has advantages in that it appraises ability to recall information and organize it into an integrated answer. However, the objective test is free of irrelevant factors such as handwriting quality, grammatical interpretations, and it also provides ease of scoring.

Obviously there are two factors that must be characteristic of a test in order for that test to have any value. These are validity and reliability. Validity refers to the extent to which the test measures what the tester wishes to measure. Does the score in a particular test measure the quality you wish to evaluate? Reliability refers to the precision and accuracy of the measuring device. Will the result of a particular measurement be consistent and reproducible?

The tester must then decide the desired difficulty of the test questions. The decision will depend upon the purpose of the test. When the test is to measure mastery of the basic essentials in an area, the questions should be limited to basic essentials. If a test is administered to discriminate levels of achievement of different members of a group, then some questions should be easy, some moderately difficult, and some sufficiently difficult to determine the ablest members of the group.

In respect to this, one may pause to review the purpose of theoretical examinations as administered by state boards of pharmacy. Is such an examination administered to measure mastery of the basic essentials in an area or is it administered to discriminate levels of achievement of different members of a group? It must be kept in mind that such an examination is administered to a select group, each member of which has successfully earned a college degree majoring in a specific area—that of pharmacy. Graduates, to have been originally admitted to a school of pharmacy, must have demonstrated evidence of academic ability. Once admitted they have been observed in classroom, laboratory, and participating in extracurricular activities as well. During their stay in college they have been administered some sixty-odd final examinations and many more written, oral, and performance tests. Students have had judgment passed upon them by a full faculty before being awarded a degree. They have met the curriculum requirements as designated by the American Association of Colleges of Pharmacy, for the institutions they attend have been duly accredited by that association.

From the standpoint of validity, that is to value a score as measuring a virtue or quality, one of the most serious errors committed in the field of human measurement is that which assumes the high correlation of knowledge

of facts and principles on the one hand and performance on the other. Nevertheless, examinations for medical practice, teaching, law, and pharmacy are predominantly verbal tests of fact and principle in the respective fields. Dean Joseph B. Sprowls of Temple University in 1955 stated, "Licensing examinations have often contained much material which is highly theoretical in nature and which is aimed primarily at determining whether the applicant is well grounded in the fundamentals of biology or chemistry. Under such circumstances the examination tends to become more of an evaluation of the applicant's basic training than of his competence to practice pharmacy."

A test's reliability, that is the reproducibility of results, tells us little about its validity. A test may give consistent results, but the results are meaningless unless it can be determined that the test is measuring the trait it is supposed to measure. Do tests measure the capability of an individual in practicing his chosen profession? Perhaps they merely measure the number of times an accumulation of questions about various subjects will be answered certain ways. To show a test is valid, scores must be related to subsequent behavior of the people tested. Examine the "validation" evidence for many tests and you will find they consist chiefly of showing how closely the average scores for the particular test come to the average scores of somebody else's test.

The Professional Examination Service of the American Public Health Association administers a pharmacy licensing examination in Connecticut, Kansas, Oregon, Pennsylvania, and Washington. This examination is of the objective type consisting of multiple-choice questions which was developed with the assistance of an examination committee recommended to the Professional Examination Service by the National Association of Pharmacy Boards. At my request the American Public Health Association mailed to me reliability statistics, and they were good. Also included were validity coefficients which were determined by comparing grades on the test with rank in the graduating class for students in one particular state in which the test is administered.

That there should be a correlation between state board scores and rank in graduating class is hardly surprising. Test authors are forever borrowing questions from one another, and what these correlations prove, at least to some extent, is how incestuous tests can be (3). But how much have scores been related to individual behavior and the factor of success? In all likelihood those students failing a state board examination may rank low in their graduating classes. However, this does not necessarily indicate that they will be least successful as practicing pharmacists. Someone must be last in any group that is ranked. To my knowledge there has been no study to determine the relationship, if any, between success in one's chosen profession and grades obtained in an institution of learning.

Perhaps more attention should be paid to the testing of performance as such. Performance tests of achievement claim to provide objective means for estimating the proficiency with which a task is performed. There are various types of performance which may be mentioned. The recognition test attempts to measure the individual's ability to recognize essential characteristics of a product or to identify objects such as botanical specimens. The Pennsylvania Board this year asked those being tested to identify

proprietary items. Performance tests of the recognition type are easy to prepare, but they do not measure directly the individual's mastery of a skill, technique, or procedure.

A simulated performance test is designed to copy the real-life situation or operation that the test is devised to measure. Practical state board examinations in pharmacy may be thought of as such tests. However, what may seem to be a valid sample of an isolated task may not be a valid sample of the entire situation. Physical conditions of the simulated test may not reproduce those of the performance in question. Then again it may be impossible to duplicate important psychological conditions of the examinee, such as those related to emotional aspects of the situation being simulated (4). These limitations must be recognized. In a practical state board pharmacy examination the results of the performance may happily be measured because there is a product involved. In measuring quality, the appearance, usability, quantity, and accuracy may be judged in relation to set standards. The performance of the individual must relate to judgments made during the execution if performance is to be evaluated at all.

In performance testing, the role of the observer becomes most important. Everyone is not qualified to judge, for example, the performance of a violinist. As a rule it is possible to arrange for several observers to view a performance and simultaneously make independent judgments. If the intercorrelations of the several sets of ratings are low then the reliability of judging the performance in question must be improved upon. This may be accomplished by giving special training with respect to definitions of the characteristics to be rated, by designing a rating sheet so that aspects of the performance are defined, by selecting experienced observers, and by developing instruments to measure the products produced by the performer.

In conclusion, may I state that this paper has been written to remind all of us to endeavor to improve upon testing methods inwardly by self-analysis and correction of our technics and outwardly by reevaluating our present methods and improving them as much as possible. Let us not become testocrats who believe their tests are infallible and their methods unchallengeable.

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A SELECTED BIBLIOGRAPHY OF PHARMACY IN LATIN AMERICA

GEORGIANNA SIMMONS GITTINGER

Except for personal gift copies there are very few books on the history of pharmacy or other medical sciences of Latin America in the eastern part of the United States. There is no specific bibliography, and only very brief lists in general bibliographies and histories of these sciences.

Medical Bibliography, by Fielding Garrison and Leslie T. Morton (Grafton, London, 1954), and the *Handbook of Medical Library Practice,* by Janet Doe and Mary Louise Marshall (American Library Association, Chicago, 1956) are the models used for this study. They deal with the medical sciences, but have scant references to their history in Latin America.

The Index Catalogue of the Armed Forces Medical Library, recently changed to *National Medical Library,* to July, 1957 and the *Quarterly Cumulative Index Medicus* of the American Medical Association to December, 1954 were consulted for listings of books and articles on history of medical sciences in Latin American periodicals.

Catalogues were searched in the libraries of the Medical, Pharmacy, and Dental Schools of the University of Maryland, Welch Library at Johns Hopkins, the Medical and Chirugical, and Pratt Libraries in Baltimore; and the Library of the American Pharmaceutical Association, the Armed Forces Medical Library (now the National Library of Medicine), and the Library of Congress in Washington.

Periodicals which usually have one or more historical papers include:

Argentina: *Revista del Colegio de Farmacia Nacional,* Buenos Aires, carries articles by Francisco Cignoli, member of societies of History of Pharmacy in many countries, leading historian of pharmacy in Argentina.

Brazil: *A Gazeta da Farmacia,* Rio de Janeiro, deals with pharmacy and medicine.

Columbia: *Revista Farmacéutica* (Blanco and Roca), Bogota, trade journal, carries thumbnail sketches of historic interest.

Ecuador: *Revista de la Asociación Escuela de Bioquímica y Farmacia,* Quito.

Guatemala: *La Escuela de Farmacia,* Guatemala.
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Mexico: *México Farmacéutico,* Mexico.
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Nicaragua: *Revista Farmacéutica,* Tegucigalpa.

Peru: *La Reforma Médica,* Lima; has frequent historical articles.

Journals dealing entirely with history of medical sciences are:
Revista Argentina de Historia de la Medicina, Buenos Aires.
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Because of limited time, only nineteen of the seventy book titles listed will be read, and descriptive notes may be omitted.

*Presented to the Section on Historical Pharmacy and Historical Biochemistry of the Fourth Pan-American Congress of Pharmacy and Biochemistry, Washington, D.C., 1957.

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. . . (pharmacy) should . . . challenge the ambitious youth of America to the high adventure of entering a profession which is satisfied with nothing less than the best human material and which insists on tempering that material in the fire of intense application and hard work.

John A. Goode, Am. J. Pharm. Ed., 9, 8 (1945)

PHARMACY LOOKS AT ACCREDITATION

MELVIN W. GREEN

HISTORY AND ORGANIZATION OF PHARMACEUTICAL EDUCATION

The history of American pharmaceutical education runs parallel to the history of professional education generally. In the United States early colonial pharmacists were usually pharmacist-physicians and, as frequently as not, self-styled with no training other than self-study. Soon after the Revolution, there emerged a separation of the two professions and the development of a licensing system for each. In pharmacy, as in other professions, initial training was provided only through apprenticeship or preceptorship.

Formal schooling for pharmacists was made possible with the establishment of the Philadelphia College of Pharmacy and Science in 1821 by a group of practicing pharmacists and physicians who were also the part-time teachers. Similar schools were established in New York (1829) and in Boston (1823, but regular courses of instruction were not started until 1867). Since courses of instruction in colleges of pharmacy were optional, there were a total of only about 500 graduate pharmacists produced prior to the Civil War.

During the nineteenth century over eighty-three colleges of pharmacy were started of which approximately sixty were operating at the turn of the century. Revolutionary consequences were the result of the creation of a school of pharmacy at the University of Michigan in 1868. Sixteen other universities founded schools of pharmacy during the past century. A few of these colleges have been discontinued, and many private colleges of pharmacy have since merged with prominent universities.

During the first half of the present century sweeping changes have come about in pharmaceutical education. In 1900 preliminary education, although widely varying, was commonly grammar school. This became standardized at four years of high school. The pharmacy curriculum was gradually extended from study ordinarily not over forty weeks to a regular four year college course. The requirement of a four year course leading to a bachelor of science degree in 1932 necessitated the linking of many independent colleges of pharmacy to authorized degree-granting institutions. This development, coupled with changes in the economy and problems of leadership, spelled the end of independent colleges of pharmacy with the exception of the five which still exist (1).

In 1852, the American Pharmaceutical Association was created to represent the profession of pharmacy in its broadest aspects. From its inception, it was interested in pharmaceutical education and exerted considerable influence in strengthening the education and training of pharmacists principally through its Section on Education and Legislation.

The licensing bodies, boards of pharmacy, gradually came on the scene as a result of the passage of state licensing laws governing the practice of pharmacy in the interest of the protection of the health of the citizens. The first such statute was passed in 1852 in Alabama. It was natural that boards of pharmacy should band themselves together, ultimately, into a national organization, the National Association of Boards of Pharmacy (1904), for discussion of matters of mutual interest and for easing the crossing of state lines by members of the profession through a system of reciprocity.

In 1900 the American Association of Colleges of Pharmacy was established and soon began a type of self-policing of its members which can be thought of as accrediting. However, all colleges were not members.

All three of the organizations, the American Pharmaceutical Association, the National Association of Boards of Pharmacy, and the American Association of Colleges of Pharmacy, took a lively interest in pharmaceutical education from the respective viewpoints of the practicing profession, the licensing process, and the colleges of pharmacy. The lack of uniform quality in pharmaceutical education was distressing to all, and the disparity in pattern of organization was confusing to many. Many of the mergers of colleges of pharmacy with parent universities and colleges were exceedingly loose. The dean and staff of many of the colleges did not know the language of the new university life and, consequently, too frequently took the easy out by seeking neither academic nor adequate budgetary support for their units.

PATTERNS OF PHARMACEUTICAL EDUCATION

It is of interest to observe the variegated pattern of pharmaceutical education. In the continental United States there are now seventy-five accredited colleges of pharmacy, no two of which are alike. Forty-eight colleges are parts of state-supported institutions ranging from universities to a multifaceted institute whose "emphasis is in the area of practical, vocational, and technical education." Eight colleges of pharmacy are parts of institutions controlled by a religious denomination, two are parts of municipally controlled universities, twelve are parts of privately controlled multiple-institutions, and five are independent colleges of pharmacy. Obviously the five independent colleges are completely self-contained, teaching everything themselves from English to pharmacology, but five of the state-controlled institutions are also substantially self-contained as is also one of the religious institutions. While several of the colleges are associated with medical schools, in two cases the medical school supplies the bulk of the service courses rather than the liberal arts college, and in four cases the medical school supplies part of the service courses. In two cases the college, physically, is associated intimately with the medical school but is completely self-contained or very nearly so.

Many other differences are in evidence too: differences in quality and quantity of staff, presence or absence of graduate programs, amount and quality of research, and rules for admission, promotion, and graduation of students.

Because of these differences, which are easily understood by educators but not by others, members of the profession, licensing bodies, prospective students, and alumni were confused by the variation in pattern and desired assurance that an equivalency existed.

ORGANIZATION OF THE AMERICAN COUNCIL ON PHARMACEUTICAL EDUCATION

By 1932 and the establishment of the four year course, it seemed apparent that the time had arrived when some sort of accreditation procedure was necessary if the struggle to elevate the minimal educational standards of the profession was not to have been in vain. Each of the three previously cited major pharmaceutical organizations having an interest in pharmaceutical education believed it could and should perform some kind of an accrediting and standardizing role. Since the three organizations held simultaneous conventions, it was not long

before concern of each group was communicated to the others resulting in the creation of the American Council on Pharmaceutical Education in 1932.

The Council consists of three representatives each from the American Association of Colleges of Pharmacy, the National Association of Boards of Pharmacy, and the American Pharmaceutical Association, and one from the American Council on Education (a sort of built-in generalist, as it were). In early discussions leading to the creation of the Council and while standards were being developed certain ground rules were laid down. Some of these concepts are cited as they have become an inherent part of the philosophy of operation of the Council ever since: (1) only one agency should represent the profession in accreditation activities; (2) there should be no fee beyond the initial examining fee charged to the colleges; (3) the standards should be established by a democratic process involving all phases of the profession and interested educators; (4) accreditation should not attempt to control numbers in the profession either by limiting numbers of students or numbers of schools by some predetermined ideas on the desirability of doing so; (5) the objectives of the institution itself should be taken into account in measuring the college as long as the objectives are reasonably compatible with the general understanding of the objectives of colleges of pharmacy and higher education; (6) recognizing the undesirability of colleges from a single mold, experimentation and self-study should be encouraged; (7) in so far as possible criteria or standards should be qualitative rather than quantitative; (8) the integrity of the total institution should be protected by not making unreasonable demands for pharmacy at the expense of the welfare of the total institution; (9) faculties should be encouraged to develop their programs with their eyes on the future rather than the past; (10) examinations should be so conducted as to place maximum emphasis on constructive criticism and advice rather than on policing functions; and (11) reporting should be confidential, reports should be the property of the college or university, and, as far as possible, the college should have copies of the report prior to Council action so that the basis for Council action would be known in advance. It is of interest that many of these concepts are sufficiently sound that they have been incorported into the "Criteria for Recognized Accrediting Agencies" promulgated by the National Commission on Accrediting.

The published objectives of the American Council on Pharmaceutical Education as set forth in the Certificate of Incorporation are in keeping with this philosophy and are as follows: (1) "To formulate the educational, scientific and professional principles and standards which an approved school or college of pharmacy will be expected to meet and maintain; (2) To revise these principles and standards when deemed necessary or advisable; (3) To investigate any school or college of pharmacy that requests approval of this Corporation; (4) To publish a list of approved schools and colleges of pharmacy and to revise such list annually or as frequently as deemed desirable; (5) To satisfy itself that the schools and colleges which have been approved maintain the proper standards through conferences with members of the faculties and the reinspection of any or all colleges of pharmacy at regular intervals or at such other time as may be deemed advisable. The approval of any school or college failing to maintain the standards formulated by the corporation shall be withdrawn; (6) To assist in the advancement and improvement of pharmaceutical education and registration." (2)

While the Council was established in 1932, it was slow to get a program of

accreditation started, principally due to lack of funds for adequate visitation of the colleges. The program, which was scarcely airborne by the onset of World War II, had to function on a stand-by basis until the close of the war.

During the period 1946-48, through the financial assistance of the American Foundation for Pharmaceutical Education, a survey known as the Pharmaceutical Survey (3) was conducted by the American Council on Education under the direction of Dr. Edward C. Elliott, President Emeritus of Purdue University. This Survey, published in 1948, made a thorough analysis of problems affecting pharmacy and included a number of important recommendations for pharmaceutical education and for the American Council on Pharmaceutical Education.

Among the recommendations of the Pharmaceutical Survey for the Council are to be found the following: "(1) It is recommended that the constructive influence of the Council be exerted, not only by the systematic examination, rating and accreditation of institutions, but also by serving as a coordinating center for the consideration of plans and efforts for the progressive improvement of pharmaceutical education. (2) It is recommended that the American Council on Pharmaceutical Education be provided with a properly staffed and equipped central office, directed by an executive officer, to be designated as the 'Commissioner for Pharmaceutical Education.'"

A recommendation asking for financial support for the Council resulted in annual contributions from the American Foundation for Pharmaceutical Education thus enabling the Council to (1) maintain such a central office, (2) employ a "Commissioner" known as the Director of Educational Relations, and (3) visit colleges without cost to them for the purpose of accreditation and for advising in matters of professional education in pharmacy.

RECENT ADVANCES IN PHARMACEUTICAL EDUCATION

Since 1948, rapid strides have been made in pharmaceutical education. There are many reasons for such advances such as the maturity of the returned veterans, general availability of more funds for education, the support by the above Foundation and others for scholarships and graduate fellowships, and the generally improved educational climate of the period. Nevertheless it is the contention of many in the profession and in higher education that the accreditation procedure of the Council has made substantial contributions.

Since accurate data are not at hand concerning the conditions in the colleges of pharmacy prior to the recent war and since many of the elements of progress are not easily reduced to quantitative terms, it is not easy to define the exact progress that has been made. The author will attempt to indicate some of the progress that has been made, however.

Administration and Organization: Prior to the date of the Pharmaceutical Survey there was evidence of much loose administrative and organizational relationship of pharmacy colleges within the parent university or college. A number of the pharmacy units were divisions of the arts colleges, thus limiting the accessibility of the pharmacy unit to the central administration. Frequently the central administration knew very little about the activities and problems of the pharmacy unit, the pharmacy unit did not receive a reasonable share of the budget, and the unit was hampered in its relations with the public and the profession. It was not unusual to find instances in which pharmacy was not represented on university-wide committees, and, indeed, in frequent cases the dean was not

even a member of the administrative council or equivalent policy-making and administrative group. In too many cases this resulted in low staff morale and a sense of the college of pharmacy being orphaned.

Vast improvements have been made in the organizational patterns of the colleges during recent years, participation in university-wide affairs is now the rule rather than the exception, and communication has improved between the college and the administration. We have moved away from the period of striving to get pharmacy into the university and are entering the period of getting the university into the college of pharmacy.

The academic qualifications of the deans of the colleges of pharmacy have been improved likewise. Table I compares the highest degree obtained by the deans in office during 1945 with those of 1957. It will be noted that the percentage of deans having a Ph.D. (only one had an earned D.Sc.) has risen from 40 per cent to 76 per cent. At the same time the number having as a highest degree something less than a B.S. has declined from ten to four. Since degrees below the B.S. were common under the old short-courses prior to 1932, the decline here is to a large extent the natural result of death and retirement.

Physical Facilities: At the close of World War II, colleges of pharmacy were, in general, poorly housed. It almost seemed axiomatic that pharmacy would be housed in the oldest building on campus, jammed into a dark basement, or the least desirable and usable portion of a chemistry or biology building. Lack of adequate space had hampered the educational program for a long time. One school had a pharmaceutical chemistry laboratory on the top floor of an old and dangerous building, the only egress from which was a single wooden stairway supplemented by rope ladders at the windows. One of the schools having an excellent graduate program had graduate students virtually on top of one another in a crowded, abandoned laboratory that organic chemistry no longer used because of its state of disrepair. Poor housekeeping and even lack of good sanitation were too frequently in evidence.

Offsetting this picture is to be cited the construction of sixteen new buildings solely for pharmacy, the addition of sixteen new wings onto existing structures or the erection of new buildings shared by pharmacy and other departments or schools, and thirteen cases in which major improvements and significant increase in space have been made.

Pharmacy is a profession dependent upon the basic sciences, especially biology and chemistry. Being sciences, they require scientific apparatus for research and teaching. All too frequently these apparatus were limited in quality and quantity. One school had been operating for fifteen years with microscopes discarded by the medical school as unusable. Too frequently the dean and staff had not made provision for the orderly replacement of equipment rendered inadequate by the ravages of time or obsolete by the march of progess. This situation has been improved greatly—more new equipment is in evidence and better replacement policies are generally in force.

While a number of the colleges had libraries exceptionally rich in pharmaceutical literature, there were a significant number that had large and important gaps in their holdings. One college had never bound a journal and, as a consequence, had a backlog of nearly fifty years of journals to be bound within a few years. Possibly more serious was the fact that frequently whole faculties were negligent in teaching students to use the pharmaceutical literature at hand.

In the past ten or fifteen years material improvements have been made in pharmacy libraries or the pharmaceutical holdings of university libraries. Today, most schools offer some formal instruction in library use and in the use of professional literature.

Professional Teaching Staff: Before 1932, the majority of those graduating from pharmacy colleges received less than a baccalaureate degree. Many such graduates went into teaching with little or no additional formal education. Unless such teachers had the foresight to take sufficient additional education to obtain a B.S. or A.B. degree they were not eligible for graduate school admission. Even as late as 1945, there were still as many as forty-five teachers out of 564 without a B.S. degree, but by 1957 this number had dropped to twelve out of 618. Table II shows the qualitative improvement of pharmacy staffs since 1945 as far as academic qualifications are concerned. During this period the number of schools responding to the surveys increased from sixty to seventy-two and the total full-time staff at and above the instructor's level changed from 564 to 618, while the number of full-time Ph.D.'s increased from 269 to 405. As late as 1945 there were a few colleges that had no Ph.D.'s on the professional staff.

Important though the academic qualifications of the staff may be, the scholarly attainments of the staff are of greater significance. Accurate measure of the scholarly productivity of the staff is not at hand. However, it is known that very little research and scholarly publication came out of colleges other than those offering graduate work in 1945. Here and there were a few additional scholars shining like candles in the night.

It is worthy of note that there were only about a dozen colleges of pharmacy out of seventy-five whose staff produced no publications during 1956-57. During the same year there were nearly 400 research papers published, two colleges producing over twenty-five. Thirty-three staff members from seventeen colleges wrote books, published laboratory manuals or parts of books, and ten staff members were granted U.S. patents. At least two staff members have been given National Science Foundation teaching grants for study and observation at other universities, and around a dozen teachers have studied abroad during the past decade. The colleges of pharmacy received last year well over a half-million dollars from industry, government, and private foundations for support of research and about a million and a half dollars during the past twelve years from the American Foundation for Pharmaceutical Education for graduate research fellowships.

Educational Program: As was to be expected in the days of the two year and three year courses, the programs were deficient in the basic sciences and the social sciences and humanities. In many cases even the ubiquitous freshman English was absent. In the short programs, elements of the basic sciences were intermingled with the applied professional subjects in such a way that the total program could be thought of as having a greater resemblance to vocational education than to professional education. Even after the advent of the four year program, many schools had been so indoctrinated with vocationalism that the programs were not always sound. Basic science material was often carried over into the professional program in a diluted and antiquated form, unnecessary material was taught to say nothing of the obsolete, and sequence of courses in relation to the basic sciences and other professional courses was poor and illogical.

One of the most valuable services that accreditation rendered in the earlier days of intensified Council activity was to encourage faculties to strengthen their curriculums. This was accomplished by discussions with individual staff members and deans and group conferences. It was done by advising so that the real strength of the curricula continued to reside in the individual faculties; no preconceived pattern was forced on the colleges from an outside agency.

The Council cannot claim full credit for service leading to strengthening of the curriculum, since the intense activity of the curriculum committee of the American Association of Colleges of Pharmacy, the publication by the Pharmaceutical Survey of *The Pharmaceutical Curriculum* by Blauch and Webster, and the annual teachers' conferences sponsored by the American Association of Colleges of Pharmacy and financed by the American Foundation for Pharmaceutical Education all made substantial contributions to this important matter.

Since only about 65 per cent of the practicing pharmacists today are graduates with a baccalaureate degree and the technological aspects of the profession are changing rapidly (new drugs become available at a rate exceeding one per day), it is obvious that continuing education of the practitioner is essential in the interests, not only of the profession, but the health of the public. Ten years ago, only a few colleges were participating in continuation education in any organized way; today over a third of the colleges have continuation programs and several have part-time or full-time extension personnel giving attention to this phase of the educational program.

Graduate education has improved also. In 1945 there were eighty-five graduate students in pharmacy and sciences ancillary to it; today there are over 600. Since all but the independent colleges are operating under the requirements of the parent institution's graduate school, the programs are as strong or as weak as the graduate school itself, generally. To maintain programs of this size requires a staff of greater strength from a scholarly viewpoint, and this strength, too, has spilled over into the undergraduate area thus assisting in the upgrading of pharmacy's total program.

Accrediting has played only a minor role at the pharmaceutical graduate level. It has discouraged any school from establishing a graduate program prematurely before better facilities were at hand, a scholarly, research-minded staff was assembled, and its undergraduate program was in order, and it has encouraged schools with programs already established to strengthen them in various ways. The Council has delineated some of the problems peculiar to graduate education in the pharmaceutical sciences, also, from time to time.

Substandard Colleges: When the intense program of accreditation was begun there were far too many schools that failed to meet Council standards in important respects. Consequently, a system of literal classification was begun, and colleges ranking below class A were given a reasonable length of time to reach fully accreditable status or show cause why they should not be dropped from the *List of Accredited Colleges of Pharmacy*. The Council believes that it has been eminently fair to the less well-advanced schools in this respect, and, in fact, in the eyes of many educators we may have erred on the side of patience. The Council worked with such colleges and tried to be as helpful as possible during this trying period. However, a few colleges were not able to meet Council standards without making other arrangements. One independent college, sensing its inability to go it alone, raised over half a million dollars and used

it as a dowry to become part of a municipal university of high repute. Another independent college of pharmacy dissolved, but was instrumental in persuading the state university to establish a college of pharmacy and absorb its student body and alumni. One college of pharmacy associated with a small liberal arts college that had been ill-advised in establishing a professional school likewise dissolved but only after arrangements had been made for the establishment of a college of pharmacy at the state university to absorb its students and develop a strong program. One college associated with a relatively complex institution arranged for a merger with a university-housed pharmacy school in the same city thus setting the stage for one strong college in place of two competing schools.

At the present writing there is only one class C college remaining. The Council recently took action to abolish the literal classification system after July 1, 1959, so that henceforth all colleges are either to be accredited (comparable to the present Class A) or not.

COOPERATION WITH OTHER ACCREDITING AGENCIES

When the National Commission on Accrediting was established to correct a situation that was thought to be both chaotic and abusive, the Council cooperated by working closer with the regional accrediting associations. While this way of operation posed certain problems such as reconciliation of national standards with regional ones, and scheduling, it offered advantages to the Council also. When the Council participated in multiple examinations of complex institutions, the Council examiners had an opportunity to get a more detailed view of the total institution and pharmacy's place in it. This overview yielded a few surprises such as the case where pharmacy's program was stronger in many respects than that of the institution as a whole. Even more satisfactory has been the arrangement whereby observers or generalists from the regional agency participate in the Council examinations. This provides an opportunity to discuss and learn about broader relationships as they arise without being subject to a larger mass of extraneous data too difficult to assimilate quickly.

This symbiotic relationship between the regional and the professional agencies appears to be stimulating to both agencies as well as helpful to the educational institutions. Among other things it has shown are the differences in capacities for self-evaluation among the institutions and the many weak spots that need attention in the universities as well as the almost shameful neglect of education on the part of the public.

Recently in an article *Who's In Charge Here?* (4), Dean Dayton D. McKean concluded by saying "So who's in charge here? Not the faculty, not the deans, not the president, not the trustees. Not even entirely the potent professional associations. But all are in varying degrees over different times. This pragmatic pluralism, so characteristic of American life, is characteristic of academic life also, and so far as we can tell, will continue to be. The matter is neither all wrong nor all right but a mixture—often an exasperating mixture—of the two. It is gray rather than black or white, but it seems to be getting whiter year by year."

We are in agreement with Dean McKean's cogent summary and would add to it only the thought that the alternative to such a pluralism would seem to be some kind of centralized control which I feel sure neither the professional organizations nor the institutions of higher learning would like to see.

TABLE I.

HIGHEST DEGREE OF DEANS 1945 AND 1957

	After DuMez 1945(5)		*1957*	
	Number	*%*	*Number*	*%*
Ph.D. and D.Sc.	24	40	55	76
J.S.D.	1		0	
M.D.	3		0	
D.V.M.	1		0	
M.S., M.B.A., or M.A.	18	30	13	18
Ph.M.	1		0	
B.S.	2		0	
Less than B.S.	10	17	4	6
Total Reported	60		72	

TABLE II.

HIGHEST DEGREE OF PHARMACY FACULTIES BY RANK 1945(5) AND 1957

	Total		*Ph.D.*		*M.S.*		*B.S.*		*non-B.S.*	
	1945	*1957*	*1945*	*1957*	*1945*	*1957*	*1945*	*1957*	*1945*	*1957*
Total	564	618	269	405	161	156	89	45	45	12
Professors	227	166	134	141	55	19	15	0	23	6
Assoc. Prof.	82	165	51	129	22	32	6	1	3	3
Assist. Prof.	124	178	64	131	41	41	17	4	2	2
Instructors	131	109	20	4	43	64	51	40	17	1

REFERENCES

(1) Sonnedecker, Glenn, and George Urdang, *Higher Education*, 9, 133 (1953).
(2) "Accreditation Manual," Fifth Edition, Americal Council on Pharmaceutical Education, 77 W. Washington Street, Chicago 2, Illinois, 1952.
(3) Elliott, Edward C., Director, *"The General Report of the Pharmaceutical Survey,* 1946-1949," American Council on Education, Washington, D.C.
(4) McKean, Dayton D., *The Colorado Quarterly*, 6, 395 (1959).
(5) DuMez, Andrew G., *Am. J. Pharm. Ed.*, 9, 363 (1945).

If pharmacy is to grasp the opportunity which lies at hand, it will have to raise, and not lower, educational standards.

John A. Goode, Am. J. Pharm. Ed., 9, 7 (1945)

PHARMACY ADMINISTRATION COURSES IN OUR COLLEGES OF PHARMACY*

HAROLD NELSON

INTRODUCTION

The aim of collegiate education for pharmacy administration is to train for effective management and operation of the modern drugstore. The modern drugstore is a merchandising enterprise which operates in a very highly competitive field. The pharmacist's success in operating a drugstore depends largely upon his ability to use the same managerial principles and tools that are employed in retail merchandising generally.

It is truly recognized by all educators and leaders in pharmaceutical education that pharmacy administration has become an important area of study in the curriculum of colleges of pharmacy. In a recent issue of *Drug Topics* (1), Dr. Call declares that pharmacy students today "need merchandising training." He made the following statement:

> The only way to become a better merchandiser is to learn 'on the job,' or to accelerate this training period via academic experience. College training in Marketing, Advertising, Salesmanship, Accounting, and other business subjects will greatly shorten the time necessary for the pharmacist to acquire proficiency in such areas as buying, display, store location and layout, advertising, training of personnel, inventory control, and pricing. College courses in Human Relations and Public Relations can give the student the tools with which to deal with his problems concerning store personnel and customer relations.

The American Council on Pharmaceutical Education lists the necessity of a full-time teacher of professorial rank to head the department of pharmacy administration as one of the requirements for accreditation.

The general purpose of this survey was to discover certain facts with respect to the present titles of courses that are offered in the colleges of pharmacy in the United States and the Philippine Islands. The specific purpose was to determine whether any improvement could be made in the pharmacy administration program as it is at the present time. There seems to be a great diversity of opinion regarding what subjects should be included in the pharmacy administration curricula. This indicates the need for information that will aid in determining what courses should be included in the pharmacy administration curricula in the colleges of pharmacy. It is with this problem in mind that this study was undertaken hoping that it will be of value to those who are responsible for the preparing of pharmacy administration curriculum and also to aid in the developing of standard terminology for course titles.

This study included seventy-three colleges of pharmacy in the United States and the Philippines. However, according to the American Council on Pharmaceutical Education, there are seventy-eight accredited colleges of pharmacy.

A questionnaire was sent to the dean of each college of pharmacy. All of the colleges except two replied promptly by either completing the questionnaire or sending letters explaining the reason for not giving the information desired.

Data were then tabulated from the questionnaires that were returned, and tables were made showing the results of the findings.

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* Presented to the Section on Pharmaceutical Economics and Management, Fourth Pan-American Congress of Pharmacy and Biochemistry, Washington, D.C., November 3-9, 1957.

SCOPE OF PHARMACY ADMINISTRATION

In order to determine the scope of pharmacy administration in the colleges of pharmacy it was necessary to investigate the courses offered, the course titles and descriptions at the undergraduate level, the number of students enrolled, and the number of teachers engaged in teaching the pharmacy administration subjects.

The questionnaire method of research was used and the questionnaires were sent to seventy-eight colleges located in forty-three states, Washington, D.C., Puerto Rico, and the Philippines. Seventy-four, or 94.9 per cent, of these seventy-eight colleges returned usable questionnaires. The data secured were classified and arranged in tables.

The returns from the questionnaire sent to seventy-eight colleges of pharmacy are shown in Table I. Only two, or 2.5 per cent, failed to return the questionnaire. One college replied stating that it will commence its educational operation September, 1957; one other college reported it must decline answering any questionnaires.

It is interesting to note the various organizational plans in our colleges of pharmacy, as shown in Table II. Forty-three, or 58.9 per cent, are on a four year plan. There are seventeen, or 23.3 per cent, that operate on 1-3 year plan; that is, one year as prepharmacy and three years as professional. It should be mentioned at this point that by 1960 all colleges of pharmacy will begin to require five years of college instruction before granting degrees. However, at present, only twelve colleges have a five year curriculum. One college requires two years of prepharmacy and four years of professional study before a degree is granted.

TABLE I

Returns on Questionnaires Sent to Seventy-Eight Colleges of Pharmacy, 1956-57

Group	*Frequency*	*Per Cent*
1	2	3
1. Colleges offering Pharmacy Administration from whom questionnaires were received	74[a]	94.9
2. Colleges offering Pharmacy Administration from whom no questionnaires were received	2	2.5
3. College replying saying that it will commence its educational operation September, 1957	1	1.3
4. College replying saying it must decline answering questionnaire	1	1.3
Total	78	100.0

[a] One questionnaire arrived too late to be included in the study.

The range of enrollment in seventy-three colleges of pharmacy is shown in Table III, the total enrollment being 16,596 students. The average enrollment of the colleges, as found in this study, was 227.3 students. Five colleges have enrollments of over 500, and forty-nine colleges have enrollments of less than 250, as shown in Table III. The enrollments were found to range from thirty-

TABLE II
Organizational Plan in Seventy-Three Colleges of Pharmacy, 1956-57

Organizational Plan	*Frequency*	*Per Cent*
1	2	3
1-3 Year	17	23.3
1-4 Year	7	9.6
2-3 Year	3	4.1
4 Year	43	58.9
5 Year	2	2.7
2-4 Year	1	1.4
Total	73	100.0

four students in the smallest college of pharmacy to 560 in the largest college of pharmacy.

PERSONNEL

A study of this kind would be quite deficient without a personnel study of the teachers employed in the colleges of pharmacy. The number of full-time teachers employed who are teaching pharmacy courses range from three to fifty, as shown in Table IV. Twelve colleges, or 16.3 per cent, hire six teachers; ten colleges, or 13.7 per cent, hire five teachers; and nine colleges, or 12.3 per cent, hire eight teachers to teach pharmacy subjects. A total of 732 full-time teachers are employed by the seventy-three colleges of pharmacy.

There are employed in our colleges of pharmacy a total of fifty-nine full-time teachers of pharmacy administration, as shown in Table V. Forty-six colleges, or 63 per cent, hire one full-time teacher of pharmacy administration. Twenty-one colleges do not employ a full-time teacher to teach subjects in pharmacy administration.

TABLE III
Enrollment in Seventy-Three Colleges of Pharmacy, 1956-57

Enrollment	*Number of Institutions*	*Total Enrollment*	*Average Enrollment*
1	2	3	4
551-600	1	560	560
501-550	4	2,100	525
451-500	0	0	0
401-450	3	1,292	431
351-400	5	1,841	384
301-350	2	645	323
251-300	9	2,390	266
201-250	15	3,378	225
151-200	12	2,136	178
101-150	11	1,418	129
51-100	10	802	80
1-50	1	34	34
Total	73	16,596	227.3

TABLE IV

Number of Full-Time Teachers Employed in Seventy-Three Colleges of Pharmacy, 1956-57

Number of Full-Time Teachers	*Number of Institutions*	*Total Teachers*	*Per Cent of Total Institutions*
1	2	3	4
50	1	50	1.4
35	1	35	1.4
23	2	46	2.7
21	1	21	1.4
20	1	20	1.4
19	1	19	1.4
18	1	18	1.4
16	3	48	4.1
15	1	15	1.4
14	6	84	8.2
13	1	13	1.4
12	2	24	2.7
11	2	22	2.7
10	4	40	5.5
9	4	36	5.5
8	9	72	12.3
7	7	49	9.6
6	12	72	16.3
5	10	50	13.7
4	3	12	4.1
3	1	3	1.4
Total	73	732	100.0

TABLE V

Number of Full-Time Teachers Teaching Pharmacy Administration Courses in Seventy-Three Colleges of Pharmacy, 1956-57

Number of Teachers	*Number of Institutions*	*Total Teachers*	*Per Cent of Total Institutions*
1	2	3	4
5	1	5	1.4
4	0	0	0
3	0	0	0
2	4	8	5.5
1	46	46	63.0
0	21	0	28.7
No Data	1	0	1.4
Total	73	59	100.0

Seventy-three colleges employ 171 teachers who teach one or more courses in the area of pharmacy administration, as shown in Table VI.

Many colleges of pharmacy follow a practice of employing part-time teachers to teach courses in pharmacy administration. It was found that in one college eleven courses were taught by part-time teachers, as shown in Table VII. In fourteen colleges, or 19.2 per cent, three courses were taught by part-time teachers; and in twenty-four colleges, or 32.9 per cent, none of the courses in pharmacy administration were taught by part-time teachers.

It will be of interest to note from what various professions part-time teachers of pharmacy administration are selected. Table VIII lists thirteen professions of part-time teachers. It was found that twenty-six of the part-time teachers of pharmacy were lawyers, twenty-four were accountants, and eighteen were pharmacists.

PHARMACY ADMINISTRATION COURSES

The tables in this chapter give in summarized form data concerning the number and per cent of colleges offering each pharmacy administration subject, the name of the department and college in which pharmacy administration courses are found, and the number of semester hours of credit offered for each course. This information was secured from the questionnaire.

Table IX presents a list of the subjects included in the pharmacy administration curricula of the seventy-three colleges of pharmacy under consideration in this study and the percentage of colleges offering each subject.

TABLE VI

Number of Teachers Teaching One or More Pharmacy Administration Courses in Seventy-Three Colleges of Pharmacy, 1956-57

Number of Teachers	*Number of Institutions*	*Total Teachers*	*Per Cent of Total Institutions*
1	2	3	4
5	2	10	2.7
4	10	40	14.0
3	22	66	30.1
2	20	40	27.3
1	15	15	20.5
0	2	0	2.7
No Data	2	0	2.7
Total	73	171	100.0

TABLE VII

Number of Courses in Pharmacy Administration Taught by Part-Time Teachers in Seventy-Three Colleges of Pharmacy, 1956-57

Number of Courses	*Number of Institutions*	*Total Courses*	*Per Cent of Total Institutions*
1	2	3	4
11	1	11	1.4
10	0	0	0
9	0	0	0
8	0	0	0
7	0	0	0
6	0	0	0
5	3	15	4.1
4	4	16	5.5
3	14	42	19.2
2	12	24	16.4
1	13	12	17.8
0	24	0	32.9
No Data	2	0	2.7
Total	73	120	100.0

TABLE VIII

Professions from Which Part-Time Teachers of Pharmacy Administration are Selected in Seventy-Three Colleges of Pharmacy, 1956-57

Professions of Part-Time Teachers	*Frequency*	*Per Cent*
1	2	3
Lawyer	26	21.5
Accountant	24	19.8
Pharmacist	18	14.9
Business Administration Department	5	4.1
Economist	3	2.5
Graduate Student	3	2.5
Hospital Administrator	3	2.5
Display and Advertising Consultant	2	1.7
Secretary—State Board of Pharmacy	1	.8
A.F.P.E. Teaching Fellow	1	.8
District Manager, Pharmaceutical Companies	1	.8
Marketing and Management Specialist	1	.8
Business Manager of College	1	.8
Doctor	0	0
No Data Given	32	26.5
Total	121[a]	100.0

[a] The total frequency is greater than the number of colleges returning questionnaires because some of the colleges employ several part-time teachers to teach the various courses in pharmacy administration.

TABLE IX

Pharmacy Administration Subjects Offered in Seventy-Three Colleges of Pharmacy, 1956-57

Subjects	*Frequency*	*Per Cent of Colleges Offering the Subject*
1	2	3
Principles of Economics	65	89.0
Drug Marketing[ab]	50	68.5
Pharmacy Accounting[c]	68	93.2
Pharmacy Management[d]	70	95.9
Pharmaceutical Law	71	97.3
Business Law[e]	37	50.7
Hospital Pharmacy Administration	6	8.2
Advertising	4	5.5
Salesmanship	3	4.1
Detailing	2	2.7
History & Ethics of Pharmacy	2	2.7
Personnel Management	2	2.7
Sales Management	2	2.7
Retail Merchandising	2	2.7
Merchandising and Selling	2	2.7
Display and Salesmanship	2	2.7
Commercial Pharmacy	1	1.4
Advanced Management	1	1.4
Advanced Marketing of Drug Products	1	1.4
Advanced Retailing	1	1.4
Advertising Drug Products	1	1.4
Selling Drug Products	1	1.4
Inter-Professional Relations	1	1.4
Elementary Business Statistics	1	1.4
Business & Professional Speaking	1	1.4
Retail Sales Promotion	1	1.4
Short-Term Finance	1	1.4
Business Report Writing	1	1.4
Business Correspondence	1	1.4
Principles of Marketing	1	1.4
Principles of Retailing	1	1.4
Wholesale Management	1	1.4
Retail Advertising—Writing & Production	1	1.4
Personal Salesmanship	1	1.4

TABLE IX (Continued)

Subjects	*Frequency*	*Per Cent of Colleges Offering the Subject*
1	2	3
Speech	1	1.4
Business Cycles	1	1.4
Analysis of Financial Statements	1	1.4
Income Tax Procedures	1	1.4
Cost Analysis	1	1.4
Drugstore Promotion	1	1.4
Professional Relations	1	1.4
Retail Store Management	1	1.4
General Accounting	1	1.4
Advertising and Public Relations	1	1.4
Pharmacy Administration	1	1.4
Law	1	1.4
Show Card Design and Window Display	1	1.4
Business Practice	1	1.4
Medicinal Adjuncts	1	1.4
Professional Communications	1	1.4

[a] Four colleges include Drug Marketing with Pharmacy Management.
[b] One college combined Drug Marketing with Pharmacy Management and New and Official Preparations.
[c] Two colleges include Pharmacy Accounting with Pharmacy Management.
[d] One college includes Pharmacy Management with Drug Marketing.
[e] Seven colleges combined Business Law with Pharmacy Law. Two colleges combined Business Law with Pharmacy Management.

A brief study of this table reveals the fact that some of these subjects are much more widely taught than others. Pharmaceutical Law ranked first as seventy-one, or 97.3 per cent, of the colleges offer a course under that title. Pharmacy Management ranks next in popularity. Ninety-five and nine-tenths per cent of the reporting colleges indicated that this subject is given. Pharmacy Accounting is reported by 93.2 per cent of the reporting colleges. Drug Marketing is taught in 68.5 per cent of the colleges reporting and Principles of Economics in 89 per cent.

It should be noted that Business Law is offered as a separate course in thirty-seven, or 50.7 per cent, of the colleges. Seven colleges combined Business Law with their course in Pharmacy Law while two colleges make Business Law a part of Pharmacy Management. Four colleges include Drug Marketing with Pharmacy Management; also one college combines Drug Marketing with two courses in its curriculum, namely, Pharmacy Management and New and Official Preparations.

It was found that the six subjects, as set forth in the Pharmaceutical Curriculum (2), are taught in seven different departments, as shown in Table X.

Since most of the colleges of pharmacy are a part of a university, it will be of interest to note that the six subjects set forth in the Pharmaceutical Curriculum (2), are given by six different colleges, as shown in Table XI.

TABLE X

Department in Which Pharmacy Administration Subjects are Taught in Seventy-Three Colleges of Pharmacy, 1956-57

Subjects	DEPARTMENT					
	Economics	*Business Administration*	*Pharmacy Administration*	*Pharmacy*	*Department Not Given*	*Accounting*
1	2	3	4	5	6	7
Principles of Economics	38	6	8	2	11	
Drug Marketing	1	10	18	12	9	
Pharmacy Accounting	3	12	19	6	18	10
Pharmacy Management		3	26	23	18	
Pharmaceutical Law			26	28	17	
Business Law	5	14	7	1	10	

TABLE XI

College in Which Pharmacy Administration Subjects are Taught in Seventy-Three Colleges of Pharmacy, 1956-57

Subjects	COLLEGE				
	Arts and Science	*Business Administration*	*Pharmacy*	*College Not Given*	*School of Government*
1	2	3	4	5	6
Principles of Economics	22	20	13	9	1
Drug Marketing	3	6	32	9	
Pharmacy Accounting	6	22	31	9	
Pharmacy Management		3	57	10	
Pharmaceutical Law			58	13	
Business Law	7	16	9	5	

A summary of the subjects offered in seventy-three colleges is shown in Table XII. It will be noted that the modal hours of credit offered in the majority of the subjects is three semester hours. Pharmacy Management has the greatest range, offering from one to eight semester hours of credit. Pharmaceutical Law ranks second in offering the greatest range of semester hours of credit, namely, two-thirds to six semester hours.

A careful study of Table XIII will show that a number of colleges have given their courses a different title than that recommended by *The Pharmaceutical*

Curriculum (2). It was found tht twenty-four course titles were used in place of the recommended title, Pharmacy Management. Drug Marketing ranked second with twelve course titles other than the recommended title.

Table XIV presents the number of colleges using other titles for pharmacy administration that those suggested by Blauch and Webster (2). It will be noted forty-one of the seventy, or 58.6 per cent, colleges offering Pharmacy Management used other titles to describe the course offered; twenty-one of the fifty, or 42 per cent, do not list their course in Drug Marketing by the recommended title.

TABLE XII

Semester Hours of Credit in Twenty-Six Pharmacy Administration Subjects Offered in Seventy-Three Colleges of Pharmacy, 1956-57

Subjects	*Semester Hours of Credit*	*Modal (average) Hours of Credit*
1	2	3
Principles of Economics	2 to 6	3
Drug Marketing	2 to 6	3
Pharmacy Accounting	1 to 6	3
Pharmacy Management	1 to 8	3
Pharmaceutical Law	⅔ to 6	2
Business Law	1½ to 6	3
Advanced Management	6	6
Advanced Marketing of Drug Products	3	3
Advanced Retailing	3	3
Advertising Drug Products	3	3
Selling Drug Products	3	3
Hospital Pharmacy Administration	2 to 3	2 and 3
Advertising	3	3
Inter-Professional Relations	1	1
History of Pharmacy	2 to 3	2 and 3
Speech	3	3
Medical Detailing	3	3
Drugstore Promotion	3	3
Professional Relations	2	2
Display and Salesmanship	2	2
Advertising and Public Relations	2	2
Salesmanship	2	2
Merchandising and Selling	3	3
Professional Communications	2 to 3	2 and 3
Medicinal Adjuncts	2	2
Show Card Design and Window Display	2	2
Detailing	2	2
Commercial Pharmacy	2	2
Retail Store Management	3	3
General Accounting	3	3

TABLE XIII

Course Titles Used Instead of Those Listed in the Pharmaceutical Curriculum by Blauch and Webster in Seventy-Three Colleges of Pharmacy, 1956-57(2)

Course Titles Used	*Frequency*	*Per Cent*
1	2	3
PRINCIPLES OF ECONOMICS		
Elementary Economics	1	.8
Introduction to Economic Principles	1	.8
Pharmaceutical Economics	2	1.6
Economic Principles and Problems	1	.8
Economics	2	1.6
Basic Economics	1	.8
Introduction to Economics	2	1.6
General Economics	1	.8
Economics II	1	.8
DRUG MARKETING		
Marketing of Drug Products	5	3.8
Principles of Pharmacy Administration	1	.8
Marketing	5	3.8
Current Pharmaceuticals	1	.8
Economics	1	.8
Pharmacy Management	2	1.6
Drugstore Management	1	.8
Principles of Marketing	1	.8
Pharmaceutical Administration	1	.8
Pharmacy Administration	1	.8
Drugstore Retailing	1	.8
Commercial Pharmacy	1	.8
PHARMACY ACCOUNTING		
Elementary Accounting	5	3.8
Accounting	5	3.8
Principles of Accounting	6	4.7
Drugstore Accounting	2	1.6
Pharmacy Management	1	.8
Elements of Accounting	1	.8
Pharmaceutical Accounting	1	.8
Accounting 6.1	1	.8
PHARMACY MANAGEMENT		
Drugstore Management	9	7.0
Drug Merchandising	1	.8
Principles of Pharmacy Administration	1	.8
Retail Pharmacy Management	4	3.1
Management of Retail Pharmacies	2	1.6
Drugstore Business Methods	1	.8
Drugstore Problems	1	.8
Policies and Promotion	1	.8
Pharmaceutical Economics	3	2.4
Drugstore Retailing	1	.8

TABLE XIII (Continued)

Course Titles Used	*Frequency*	*Per Cent*
1	2	3
Retail Merchandising	1	.8
Pharmaceutical Business Management	1	.8
Commercial Orientation	1	.8
Retail Drugstore Management[a]	1	.8
Administrative Pharmacy[a]	1	.8
Retailing	1	.8
Pharmacy Management	1	.8
Drugstore Management and Merchandising	1	.8
Pharmacy Administration	2	1.6
Management	1	.8
Store Management	1	.8
Pharmaceutical Administration	2	1.6
Commercial Pharmacy	2	1.6
Retail Drugstore Operation	1	.8
PHARMACEUTICAL LAW[b]		
Jurisprudence	6	4.7
Pharmacy Law	4	3.1
Pharmaceutical Jurisprudence	10	7.8
Professional Law	1	.8
Pharmaceutical Legislation and Ethics	1	.8
Jurisprudence and Ethics	1	.8
Pharmacy Laws	1	.8
BUSINESS LAW[b]		
Elementary Business Law	1	.8
Commercial Law	1	.8
Jurisprudence[c]	2	1.6
Economics	1	.8
Pharmaceutical Economics[d]	1	.8
Pharmacy Administration	1	.8
Total	127	100.0

[a] One school offers these two courses instead of Pharmacy Management.
[b] Combined under title of Pharmaceutical Law.
[c] Business Law and Pharmaceutical Law to be combined and called Jurisprudence.
[d] Instead of Business Law and Accounting.

An attempt was made to discover what titles would best describe the courses in pharmacy administration, as shown in Table XV. A study of the table will show that many of the recommendations for a more appropriate title give thought to titles that better explain the type of course.

Forty-three colleges of pharmacy indicate that present titles are satisfactory although they do not in all instances use the titles as set forth in *The Pharmaceutical Curriculum* (2). Nineteen colleges of pharmacy recommend titles that may be more appropriate than the present titles of courses in pharmacy administration.

A study of the questionnaires revealed the fact that forty-three, or 58.9

TABLE XIV

Course Titles Used Instead of Those Listed in the Pharmaceutical Curriculum by Blauch and Webster in Seventy-Three Colleges of Pharmacy, 1956-57(2)

Subjects	*Number of Institutions Offering Course*	*Number of Institutions Using B & W Title of Course*	*Number of Institutions Using Other Titles*	*Per Cent Using Other Titles*
1	2	3	4	5
Principles of Economics	65	53	12	18.5
Drug Marketing	50	29	21	42.0
Pharmacy Accounting	68	46	22	32.4
Pharmacy Management	70	29	41	58.6
Pharmaceutical Law	71	47	24	33.8
Business Law	37	30	7	18.9
Total	361	234	127	37.9

per cent, of the colleges of pharmacy indicated that the subject-matter offerings and program of study were sufficient to fulfill the purpose for pharmacy administration, as shown in Table XVI. Twenty-nine of the colleges admitted definitely that their present pharmacy administration program of study was somewhat lacking in the purpose of education for pharmacy administration. Skepticism is sometimes expressed about the introduction of adequate instruction in pharmacy administration in the pharmacy curriculum for fear it may prove inimical to professional ideals and standards. This danger can be eliminated if sufficient instructional time is given so that the ethical and social aspects of pharmacy administration may be given as well as its operating principles. It should be recognized that this field must have the same careful study as other areas of the pharmacy curriculum; it should not be limited only to teaching activities, but should also include ample research.

TABLE XV

The Most Appropriate Course Title Recommended to be Used in Place of Present Title Used in Seventy-Three Colleges of Pharmacy, 1956-57

Present Title Used	*Recommended Title*
1	2
Drugstore Operation	Pharmacy Management I
Drug Merchandising	Pharmacy Management II
Jurisprudence	Pharmaceutical Law
Elementary Economics	Principles of Economics
Elementary Accounting	Pharmacy Accounting Principles of Accounting
Drugstore Management	Fundamentals of Marketing (Distribution) Pharmaceutical Economics Pharmacy Management

TABLE XV (Continued)

Present Title Used	*Recommended Title*
1	2
Commercial Law	Business Law
Introduction to Economic Principles	Principles of Economics
Marketing of Drug Products	Drug Marketing
Retail Pharmacy Management	Pharmacy Management
Pharmaceutical Jurisprudence	Pharmaceutical Law
Pharmaceutical Economics	Economics Drugstore Management
Drugstore Practice	Drugstore Management
Pharmacy Administration	Pharmaceutical Administration Drug Marketing
Economics	Economics and Marketing
Accounting	Accounting Fundamentals
Pharmaceutical Jurisprudence and Economics	Pharmaceutical and Business Law
Pharmaceutical Business Management	Drugstore Management
Pharmaceutical Accounting	Accounting for Pharmacists or Drugstore Accounting
Pharmacy Management	Drugstore Operation and Management
Pharmacy Laws	Drugstore Operation and Management
Commercial Orientation	
Retailing	Pharmacy Management and Operation
Advertising and Public Relations	Principles of Advertising and Public Relations
Principles of Economics	
Introduction of Accounting Principles	
Economics of Retailing	
Pharmacy Law	Pharmaceutical Jurisprudence
Law	Pharmaceutical Law
Business Practice	Business Practice or Accounting
Commercial Pharmacy	Retail Pharmacy Management
Drug Marketing	Marketing of Drug Products
Marketing	Drug Marketing

One college plans to condense the courses Retail Drugstore Management and Pharmacy Administration into one course called Pharmacy Administration, 4 quarter hours credit.

Forty-three colleges of pharmacy indicate that present titles are satisfactory.

Nineteen colleges of pharmacy recommend titles that may be more appropriate than present titles.

Ten colleges of pharmacy give no opinion.

One college of pharmacy is studying course titles.

TABLE XVI

Subject-Matter Offerings and Programs of Study Sufficient to Fulfill the Purposes of Education for Pharmacy Administration in Seventy-Three Colleges of Pharmacy, 1956-57

Item	*Frequency*	*Per Cent*
1	2	3
Yes	43	58.9
No	29	39.7
No Definite Opinion	1	1.4
Total	73	100.0

The colleges that indicated the weakness of their program in pharmacy administration listed the subjects or made comments they felt were required to strengthen their purpose of education for pharmacy administration.

Several of the colleges indicated that by offering more specific courses dealing with aspects of pharmacy administration they could better fulfill the purposes of education for pharmacy administration. The following courses were suggested: Principles of Economics, Business Law, Business Correspondence, Public Speaking, Typewriting, Advertising, Salesmanship, Marketing, and Statistics.

In analyzing the returns in regard to the question as to how the present program of study of education for pharmacy administration could be improved, the following are some of the statements given in the returns to strengthen a number of aspects of pharmacy administration:

a. "Have our own course in Drug Marketing in place of 'Marketing' offered by Department of Business."

b. "Requiring more business subjects as electives."

c. "Drugstore Practice changed to Drugstore Management with increase in credit hours from two to four."

d. "Pharmacy Accounting as separate course and not included in Pharmacy Management."

e. "Students should have more business principles."

f. "More extension services to practicing pharmacists."

g. "Need more time for Pharmaceutical Jurisprudence."

h. "More practical application to retail pharmacy should be stressed in Accounting. More time needed for Pharmacy Management and Law. Need electives to supplement and broaden students who indicate interest in pharmacy administration."

i. "We would like more Business Law, which we do not give, and combine it with Pharmaceutical Jurisprudence into a minimum of four credit hours."

j. "Money and Banking or Finance are highly desirable."

k. "To avoid criticisms as to quality and quantity of courses we should strive to make the 'business courses' taught in pharmacy conform as close as possible to those taught in business administration."

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

The purpose of this study was to examine the pharmacy administration curriculum in the colleges of pharmacy in the United States and the Philippine Islands. The findings represent the present practices in each college and also furnish a basis for determining what specific steps should be taken in improving the situation as to particular courses that should be included other than those set forth in *The Pharmaceutical Curriculum* (2). The writer, who served as chairman of a special committee (3), desired to ascertain facts necessary to aid in the development of standard terminology for course titles.

Pharmacy administration has a definite and established place in the curricula of the colleges of pharmacy in the United States and the Philippine Islands. This is evidenced by the fact that every college offers courses in pharmacy administration. There is a lack of uniformity in the titles for the courses offered in this field, which leads us to consider the need for information which will aid in consolidating all courses that pertain to pharmacy administration under one department. A great number of the colleges of pharmacy are not departmentalized formally.

The questionnaire showed that pharmacy administration plays a vital role in the colleges of pharmacy in the United States and Philippine Islands. The returns from seventy-three colleges of pharmacy provided the data for the study. The primary purpose of the pharmaceutical curriculum today is to train the student not only as a professional man, but also as a professional business man (4).

The following conclusions are drawn from the information gained as evidence in this study:

1. Forty-three of the colleges of pharmacy operate on a four year plan.

2. The total enrollment in the seventy-three colleges of pharmacy was 16,596 students ranging from thirty-four students in the smallest college to 560 in the largest college.

3. The number of full-time teachers who are teaching pharmacy courses ranged from three to fifty.

4. Fifty-nine full-time teachers of pharmacy administration are employed in our colleges of pharmacy.

5. Seventy-three colleges employ 171 teachers who teach one or more courses in the area of pharmacy administration.

6. The number of courses in pharmacy administration taught by part-time teachers ranged from none to eleven.

7. Part-time teachers of pharmacy administration are selected from thirteen different professions.

8. There are fifty different pharmacy administration subjects scattered through the curricula of the seventy-three colleges of pharmacy.

9. Seven different departments and six colleges are responsible for the teaching of pharmacy administration courses.

10. The credit offered in twenty-six subjects ranged from two-thirds to eight semester hours. The modal is three semester hours of credit.

11. Sixty-six different course titles are used to describe the six basic courses as recommended in *The Pharmaceutical Curriculum* (2).

12. Forty-three colleges of pharmacy indicated that the present subject-matter offerings and program of study were sufficient to fulfill the purpose for pharmacy administration.

It is believed that the pharmacy student would be better served if the present range of subjects offered were narrowed down to the six basic subjects as set forth in *The Pharmaceutical Curriculum* (2).

It is recommended that the titles of all pharmacy administration courses be made uniform and that titles of elective courses in pharmacy administration or business administration conform to the usually accepted titles.

It is recommended that all colleges of pharmacy, in order fully to meet accreditation standards, engage a full-time teacher of professorial rank as head of the Department of Pharmacy Administration.

Following are the suggestions for further research in the field of pharmacy administration in the colleges of pharmacy:

A study of pharmacy administration courses as proposed in the five year program.

A more detailed and complete study of requirements in the department of pharmacy administration.

A study to show how well titles of courses describe the subject matter in the course.

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(2) Blauch, Lloyd E., and George L. Webster, "The Pharmaceutical Curriculum," American Council on Education, Washington, D.C., 1952, pp. 169-185.

(3) American Association of College of Pharmacy, Conference of Teachers, Section of Teachers of Pharmacy Administration. *Committee on Developing Standard Terminology for Course Titles and Descriptions in Pharmacy Administration at the Undergraduate Level.* A report prepared by Harold Nelson, Chairman, Dr. Paul C. Olsen, and Dr. Joseph Kern. New York: American Association of Colleges of Pharmacy, April 29, 1957.

(4) Nelson, Harold, *Am. Prof. Pharm.*, 22 217 (1956).

In the well-trained pharmacy graduate lies the welfare, the hope, the security, the future of all pharmacy.

John A. Goode, Am. J. Pharm. Ed., 9, 5 (1944)

REPORT OF THE REPRESENTATIVES TO THE DRUG TRADE CONFERENCE

The annual meeting of the Drug Trade Conference was held in New York City on December 11, 1958. All constituent organizations were represented. The three delegates from the American Association of Colleges of Pharmacy, Dean Roy A. Bowers, Dean E. E. Leuallen, and Dr. Hugo H. Schaefer, were all in attendance. President H. C. Kinner presided.

After a few preliminary announcements and committee appointments, President Kinner introduced Dr. Robert P. Fischelis, who presented his report as Chairman of a Subcommittee on Uniform State Legislation to which the problem of restrictive sales had been assigned.

Dr. Fischelis first read a "clarifying" statement relative to the activities of his group and which had previously been approved by the Executive Committee of the Conference. The following paragraphs present its key points:

> The National Drug Trade Conference, or its committee, has not undertaken to intercede in any specific controversy then, later, or now, existing in any specific state. The Conference, or its committee, has had no authorization to do that, is not set up for it and does not invite it. Its authority and its purpose have been the formulation of a provision for inclusion in a Model Uniform State Pharmacy Act and the making of such studies and conducting such research as may contribute to the accomplishment of that purpose. If, as a natural by-product of the work and accomplishment of the Conference, and its committee, there should ultimately come a resolution of specific restrictive sales controversies in specific states, that would be gratifying to the Conference, and it would be added stimulus and regard for its undertaking.
>
> The National Drug Trade Conference has instructed its committee to continue its work and the Conference solicits the good will and assistance of all who endorse and support the drafting of a Model Uniform State Pharmacy Act. It hopes that if any are not able to assist in this work that they will, by this statement, understand and endorse the purpose and the undertaking of the Conference.

Dr. Fischelis further reported that his group had begun the compilation of a list of drugs which could be divided into prescription and nonprescription categories and recommended the employment of professional and clerical assistants to aid in its preparation. He stated that it was not the duty of his committee to act on federal legislation dealing with the restrictive sales issue unless he were so instructed by the Conference and, in the absence of such instructions, his committee would continue in its endeavor to prepare a satisfactory model state pharmacy act.

The next speaker was Mr. John Horan of the Legal Department of Merck & Company, who presented an outline of the current status of the several congressional committee investigations of the cost of drugs and medicines. He expressed the opinion that these investigations affected not only the manufacturer, but all other divisions of our distributive system as well, including wholesalers and retailers. He also thought that it directly endangered our country's present patent and trade-mark policies and procedures and that this had a direct bearing on the current high level of research expenses and accomplishments.

Mr. Chet Shaw, of the Health News Institute, joined the speaker, Mr. Horan, in believing that the present attacks on the industry are following a pattern which amounts to an accelerated drive for socialized medicine. He believed that the industry must be prepared for trouble, particularly from the writings of the "left-wing" press which, instead of praising and highlighting industry progress, is condemning it whenever possible.

The next speaker was Everett I. Willis of Thomas E. Dewey's legal firm who presented a paper on "Product Liability—Some Problems and Proposals." He asserted that the recent court decisions in the Cutter polio vaccine cases had so broadened the implied warranty concept as to threaten seriously the routine commercial activities of the industry as well as its technological advances. He also stated that conceivably damages could be assessed against retailers and wholesalers under the implied warranty theory when no negligence or fault exists. Mr. Willis had several constructive suggestions for meeting the situation, and these were discussed at considerable length following his talk.

The report of the Resolutions Committee was then presented in two parts. The first part dealt with changes in the Code and Rules of the Drug Trade Conference. These require only a majority vote for adoption, and all were approved.

1. *Resolved* that the name American Drug Manufacturers' Association and American Pharmaceutical Manufacturers' Association be deleted from Section 2 (a) Members and in their place one name—Pharmaceutical Manufacturers' Association—be substituted.

2. *Resolved* that under Section 4 (a) Meetings the clause—"The Conference shall hold an annual meeting . . . . between the first day of November and the fifteenth day of December"—be eliminated and in its place, the following substituted—"The Conference shall hold an annual meeting . . . . between the first day of December and the last day of March."

3. *Resolved* that under Section 2 (b) Delegates that the clause—"Duly appointed representatives of medical and pharmaceutical organizations, not members of the Conference, or other persons, may be granted the privilege of the floor by vote"—to be amended, and the following substituted—"Duly appointed representatives of medical or pharmaceutical organizations, not members of the Conference, or other persons may be granted the privilege of attending. The privilege of the floor shall be limited only to delegates."

The following resolutions were also adopted by the required unanimous vote:

1. *Resolved* that the Committee on Uniform State Legislation be continued and that the Committee be empowered to engage the necessary professional and clerical assistance, subject to the approval of the Executive Committee, to enable it to continue its study as to the classification of drugs into legend and nonlegend categories.

2. *Resolved* that the Conference go on record to emphasize to the public press and mass communications media that a differentiation be made between the use of the word "drug" and that of "narcotics."

3. *Resolved* that the NDTC formally express to its retiring Chairman, Mr. Harold C. Kinner, the appreciation of the Conference for his sincere and extensive efforts to conduct the affairs of the Conference in an efficient manner.

4. *Resolved* that this Conference extend thanks and appreciation to Messrs. John Horan, Chet Shaw, and E. I. Willis for their kindness in presenting their several interesting and informative reports at the 1958 Annual Meeting of the NDTC.

5. *Resolved* that the NDTC go upon record as lending its continuing endorsement of the aims and objectives of the American Foundation for Pharmaceutical Education; and *be it further resolved* that it be congratulated upon the progress made under capable administration; and that all segments of the pharmaceutical industry represented in the NDTC be encouraged to continue their financial support, to make possible the valuable work of the Foundation.

On recommendation of the Nominating Committee the following were elected to office: President, Robert P. Fischelis; Vice President, James A. Allen; Secretary Treasurer, Ray C. Schlotterer; Hugo H. Schaefer with Roy A. Bowers as Alternate were appointed to the Executive Committee to represent the AACP. Roy A. Bowers, E. E. Leuallen, and Hugo H. Schaefer, Representatives.

To be sure, the demand for men with highly specialized training has been unusual. But it is generally recognized that the broadly trained minds have made the most significant contributions.

Edward H. Kraus, Am. J. Pharm. Ed., 9, 548 (1945)

PRESIDENT'S SECTION

THE BUTTRESS OF PHARMACEUTICAL EDUCATION

Only the future can reveal the perspicacity of contemporary judgments and decisions. Pharmacy, like other professions and disciplines, stands upon the frame of mind of those concerned and responsible for the services of the profession. The success of pharmacy is reflected in attitudes, and attitudes are developed as a result of rational thinking versus emotional outbursts.

We have recently witnessed the projection of living animals into the upper atmosphere and their successful return to earth. Certainly this event is only one in a series of progressive experiments preparing for the inevitable and major undertaking—that of the acceleration of man into outer space. Our scientists have as their goal the moon, and several individuals have presented themselves as candidates for the initial flight. Are they representatives of the "advance agent" for pharmacy? Facetious as this remark may be, it does bring us to the realization that we must give serious thought to activities of our neighbors, and that persons so designated have increased in astronomical numbers.

It has been said with a reasonable degree of authority that within the decade, through the continual improvement of aircraft, we will be no more than two hours from the most distant point on the globe. The realization of this prediction can be rationalized by studying the velocity and durability of our present jet equipment. On this basis it does not seem unrealistic.

International seminars and conferences are no longer novelties. International industrial developments are commonplace—the American pharmaceutical industry being an excellent example of a health and welfare group no longer able to limit its research, production, and sales to our own national boundaries. Exchange professorships, international educational conferences, research seminars, and multilingual publications are common. The progress pharmacy makes will be dependent upon the qualifications of those who represent the profession—whether it be in manufacturing, education, or distribution. The reflection of the profession is so vulnerable to distortion that we should be extremely sensitive to the influence of a few individuals or minority groups who directly contribute to the profession's degradation.

Let's take a peek into our colleges of pharmacy. The majority of our schools do have foreign students enrolled. Most of our graduate colleges have representatives from foreign lands. These are the persons who have been sent to the United States with the specific objective of expanding their educational competency, developing their skills and techniques, and broadening their understanding of pharmaceutical synthesis, product development, and educational procedures. These are the individuals who, upon return to their native lands, will share their knowledge with others and will be the reflectors of American pharmacy. The task of pharmacy resides in our

ability to so regulate the principles of professional competency and ethics that, for the major part, pharmacy's prestige will gain internationally as well as interprofessionally. We must, therefore, take a philosophical view of our international responsibilities, observing international protocol and giving full consideration to internal political problems.

Education is the nose cone of the projectile which is perhaps best labeled as progress—not isolated to American progress, but progress of the world; for as we live in closer proximity to our neighbors, we will share international experiences with increasing frequency. Under these circumstances we must be certain that our contributions to the educational picture are academically, as well as professionally and scientifically, sound. The world continues to respect America for her aggressive leadership. However, unless we assume complete charge of the responsibility to advance, expand, and modify our educational processes, we will find ourselves second to the Soviet Union.

The desk of every educator is covered with bulletins on careers in the sciences, the arts, the humanities, and the social sciences. The opportunities are perhaps somewhat distorted in every area, but generally the appeal goes forth as a unified and concerted effort of the specific discipline. These are selling jobs which require an understanding of the challenges which the profession affords. The opportunities in the profession are, in turn, sold through the examples set by individual practitioners.

Pharmacy has its greatest public appeal and most dramatic approach through the pharmaceutical industry. In general, pharmaceutical industry carries its banner with distinction. Its contacts, however, are not of the intimate and personal type. Personal relationship comes through the practitioners in the conventional, prescription, and hospital pharmacies, and through the professional service and sales representatives. Unfortunately, an extensive number of so-called drugstores do not serve to buttress the profession which they purport to represent. Their challenge is commercial, their accent—economic, and their attitude toward the professional—uninviting.

The buttress for pharmaceutical education should be composed of representations of every division of the profession. Such support will serve to strengthen our professional qualifications and increase interprofessional relationships. We may expect an ever-increasing list of "wonder" drugs. Men and machines are reducing the distance between countries. Our population is increasing, thus creating an expanded demand for pharmaceutical services.

The buttress for pharmaceutical education will be substantial only if everyone concerned understands the need of the pharmacist. It must be agreed that educational standards cannot and must not remain static. The approach to a safe and secure professional future lies in the study of contemporary problems and the adaption of their solutions for future potential services.

Louis C. Zopf

EDITORIAL

Recently I was talking with one of our graduates who is a detail man for one of the large pharmaceutical manufacturing companies. The more we talked, the more disturbed I became about the present and future of this important link in the public health team, the detail man. I became disturbed because I was told that too few of the companies are taking adequate steps to choose and hold professional service representatives who are pharmaceutically trained. Companies are filling these positions with people who have only elementary knowledge of biological and physical sciences, or even worse, people who are just salesmen. Such individuals are ill-equipped to discuss the chemistry and therapeutic significance of drugs with pharmacists and medical men. I also learned that it is becoming increasingly more difficult for good detail men to get to see medical men, and their reception among the younger members of the medical profession is even more difficult. In short, the medical profession is becoming tired of having its time wasted by inadequately educated representatives who have learned rote sales lingo and who are unable to discuss intelligently what they have said, let alone answer questions. Some if interrupted have to start the speech all over again!

How such a situation has been allowed to develop is difficult to understand. There certainly has been enough written about the importance of manufacturers' sales representatives. In the excellent latest edition of Arthur F. Peterson's book, *Pharmaceutical Selling, "Detailing" and Sales Training,* the detail man has been described as having a position which

> . . . is an extremely important one in the dissemination of scientific information to the medical, pharmaceutical, and allied professions. Upon him frequently depends the saving of life or relieving from suffering by virtue of his timely introduction of a therapeutic product and his intelligent discussion of it with a physician. His opportunity to render service of extraordinary value to physicians for the benefit of their patients is in itself a source of real satisfaction.

And from the Federal Trade Commission's *Economic Report on Antibiotics Manufacture* (1958) the following:

> Undoubtedly the most important method used in promoting the sale of ethical drugs is detailing. It accounts for the largest share of the promotional dollar and appears to be the most effective means of selling.

Just what is the situation: how many detail men are pharmaceutically trained, and how many are not? To get some idea of the current picture, I wrote to the sales executives of fifteen well-known manufacturers of ethical pharmaceuticals. I received replies from eleven: Armour Pharmaceutical Company; Smith Kline & French Laboratories; G. D. Searle Company; Pfizer Laboratories; Parke, Davis & Company; Winthrop Laboratories; Roche Laboratories; Eli Lilly and Company; Lederle Laboratories; Ciba; and the Upjohn Company. The percentage of pharmacists employed as detail men for these companies are as follows: (*Please note that the sequence here has no relation to the sequence of the companies above*): 5 per cent, 8 per cent, 10 per cent, 15 per cent, 15 per cent, 40 per cent, 46 per cent, 48 per cent, 50 per cent, 90 per cent, and 95 per cent. These are interesting statistics: nine out of eleven first-line companies have half or fewer than half of their detail men who are pharmaceutically trained. The two companies who

reported the highest per cent of pharmacists are Parke, Davis & Company (90 per cent approximately) and Eli Lilly and Company (95 per cent plus).

I asked our local Lilly representative why it is that Lilly hires so many more pharmacists. He said that it is Lilly policy whenever it is at all possible to hire pharmaceutically trained men. I then asked him if in his contacts with other detail men he had discovered why Lilly can hire and keep pharmacy-trained detail men. He said he thought the answer was simple: "Lilly pays more."

According to the FTC report mentioned earlier, it was estimated that the average detail man receives about a $7,000-per-year salary. According to Tom Mahoney in *The Merchants of Life* a detail man makes about $10,000. Possibly, then, the range is in the $7,000 to $10,000 bracket.

It may be that the salary picture is the crux of the problem. I have heard that manufacturers are turning to other than pharmaceutically trained detail men because pharmacists after being hired often find more lucrative positions practicing pharmacy and don't last long in detailing. For manufacturers to turn to unequipped detail men rather than competing for pharmacists appears to me to be a head-in-sand approach which may very well lead to the disappearance of the personal representative of the manufacturers in the pharmacy and medical offices. If manufacturers continue to send out cigarette salesmen after a week or two of pharmaceutical orientation and expect them to be respected by physicians and pharmacists as *constultants* on drugs, the manufacturers must have a lower opinion of the health professions than one can imagine. Many companies say they hire men with strong backgrounds in the biological sciences or physical sciences instead of pharmacists. This is, in my opinion, dangerous rationalizing. A man to discuss drugs today must have at least four years of chemistry and pharmaceutical chemistry coupled with sound courses in physiology and pharmacology, these being only basic prerequisites. Courses in allied areas are highly desirable. Who in a college curriculum has such a program except a pharmacy graduate? A medical student is usually deficient in chemistry beyond the basic courses. He cannot be a specialist in drugs. It is not intended that he should be.

Some manufacturers make a point of hiring for detail men premedical students who weren't accepted into medical school or who flunked out once they were in. One manufacturer wrote me as follows: "We have found that our best representatives are those with strong desires to be physicians, but who were unable to satisfy that ambition. This apparently is a strong motivation force influencing these men to enter this field of activity." This is a statement which I seriously question. In my opinion, no frustrated, would-be M.D. makes a sound representative for a pharmaceutical manufacturer. Dr. William B. Hildebrand, speaking as President of the American Academy of General Practice at the 1955 meeting of the American Pharmaceutical Manufacturers' Association, said, "I think the worst one (detail man) is one who has flunked out of medical school or been denied admission because his grades are too low. We get many of these calling on us. They seem frustrated."

If the pharmaceutical manufacturer wants someone to talk about drugs, he must hire someone who is educated to *know* about drugs. There is only one training program which leads to this goal, and that program is pharmacy. The physician may know his pathology, his anatomy, his general

medicine, and his techniques; but there is only one person who is trained to understand the chemistry, biochemistry, pharmacology, pharmacognosy, and the pharmacy of drugs—the totality of drugs—the pharmacist. He stands alone. It is imperative that pharmaceutical educators make known to the manufacturers that pharmacy cannot be prostituted for the almighty dollar or sacrificed at the altar of expediency.

The situatiton is serious and getting worse. One manufacturer writes:

> Up until six years ago, over 80 per cent of our staff were registered pharmacists. The percentage of registered pharmacists is now about 48 per cent. In the past six years our replacements have been mainly chemists, premedical students, Bachelors of Science, drop outs from medical colleges and other college graduates. . . .

It appears that most pharmaceutical manufacturers are losing sight of the real importance of detail men—good detail men. Mr. Gerard Piel, Publisher of *Scientific American,* put it this way in an address to the American Pharmaceutical Manufacturers' Association:

> Your detail men are still a primary channel of communication. I understand from doctors I know that they represent the channel upon which the doctor really depends to keep abreast of what you are doing.

Petersen in the reference already cited says,

> Medicine is a very broad field of endeavor. It is only natural, then, that the physician will devote his study hours to the broader aspects of his practice. He depends in great measure upon the well-informed Professional Service Pharmacists to provide him with the more specific details on the pharmacology and therapeutics of newer remedies developed by high technical, extensive, and costly research, and on the forms in which they are administered. It merely points to the increasingly important role and the greater scientific bent and ability of the present-day P. S. P.

Mr. Robert A. Hardt, President of Armour Pharmaceutical Company, has said of the detail man,

> He calls personally on the nation's physicians to disseminate product information and serves as a 'walking medical journal' to answer the doctor's numerous questions about these products. The importance of his work cannot be overstated. If a doctor attempted to read all the articles and advertisements published about all the drugs discovered, he would have no time left to see patients on which to use them.

Marc Woodward of the Health News Institute, speaking to the Service Representatives Conference this spring, said,

> Nearly half the time a doctor learns of a new drug through the personal visit of the detail man. Few laymen realize how heavily the burden of keeping up with medical advances weighs on doctors. The doctor cannot practice medicine just as he learned it in medical school. Yet, surveys have found that his time is so taken up that the average doctor can spend only a little over half an hour a day reading medical journals, looking at mail, and interviewing detail men.

The need for quality representation of the drug industry by detail men is also accentuated by the following statement by Woodward:

> There are some 15,000 detail men in this country operating five days a week average. Even if they make only five calls a day it means they can see 75,000 Americans every day. Working five days a week they can make 375,000 contacts a week or 18,750,000 contacts a year. . . .

Imagine, 18,750,000 contacts a year. What a disaster if most of them are made by inadequate representatives! The FTC report estimated that the cost to manufacturers for calling on a physician is probably $6.50 to $7.50 per call. If the call is ineffective, what a waste of an enormous amount of money!

Dr. Hildebrand has stated very succinctly, and as an eminent physician talking to manufacturers, he didn't pull any punches:

> The doctor does not want to hear patter that obviously the representative has learned recently by heart from some sales tract that has been sent to him. Of all the things that doctors say about detail men, I believe this is the most annoying. It is extremely easy to determine whether a representative actually knows the pharmacology of the drug he is discussing or whether he has learned it from promotional material and is merely regurgitating it.
>
> If the representative is fair and honest with us, we instinctively feel confidence in and partiality towards the person and his company. If, as often happens, there is little to choose between product A, B, and C, the practitioner will make his selection on the basis of how he feels about representatives of companies A, B, and C. Such is my own personal procedure in choosing pharmaceuticals for use of my patients.
>
> Fifth, we expect your representatives to be well informed and to know their products. Such a knowledge surely implies that he should be familiar with the required technical language. Not all of them are trained in this respect. From observation, *I have felt that perhaps the ideal salesman for a pharmaceutical house is a man with a background of pharmacy college training.* If he has the other attributes of a good representative it seems to me that he makes the best representative. . . . I know representatives of pharmaceutical concerns who are excellent men; men whom I admire and men who I am happy to see at any time. Some representatives are real traveling libraries to us, giving us research material that we might never get otherwise. . . .
>
> Now, since a good many drugs fall by the wayside, either victims of fad or through clinical study which disproves their value, the question is posed as to how the busy physician can best evaluate the proposed additions to his therapeutic armamentarium. . . .
>
> Certainly one of the most important methods is by contact with your detail men. *May I point out to you that of all of your contacts with the medical profession, your detail man is the most important.* (Italics by Editor.)

I'm sure the manufacturers' reply to the alarm I express regarding the trend of the detailing picture will be to point to the fact that they are selling a lot of drugs and business is good. They are making more money than ever. All this is true, but I hope they don't give their inadequate detail men the credit. Much of that credit is due the prescription pharmacist. As more of the inadequately educated pharmacists die, even more of the responsibility of talking drugs to physicians will be imperative for the most effective treatment of the ill. The distinguished pharmacist Dr. Frederick D. Lascoff, speaking to the American Pharmaceutical Manufacturers' Association, put it this way:

> Not a day passes when pharmacists don't receive queries from physicians concerning new products—asking for therapeutic information. . . .
>
> He does not take the place of the detail men. He assists him when he feels he is getting the cooperation of the detail men and his firm. . . .
>
> The physician will certainly have greater confidence in the pharmacist who does not favor one firm only, as the detail man is bound to, particularly since the physician will increasingly realize that the pharmacist of the future is a trained scientist, not one who has been coached with some Sales Manager's "pitch," whose pharmaceutical and technical training consists only of a manufacturer's training course in one firm's products.

To acquire better detailing, more detail men must be pharmacists. To get more pharmacist detail men, they must be paid more. The obvious answer is to spend more money on promotion. The more thoughtful answer is to spend less on *ineffective* promotion. Not only should ineffective nonpharmacy detail men be eliminated, but so should some of the present promotional policies be examined. The most obvious of these policies is promotional literature. I have a friend who is a busy obstetrician. He says he lets the stuff from manufacturers form a nice unopened pile one foot high

on the end of his desk and then pushes it into the waste basket. Dr. Hildebrand in his address to manufacturers said,

> For three weeks prior to my coming here, we received an average of twenty-two pieces of medical advertising in our office every day. . . . Now at a glance one can easily understand that a busy doctor cannot even look at all the titles of the leaflets or the company sending them, let alone read them. Since I have been particularly interested in this subject, I have read many more of them than I usually do, and I must say that unless it is something that the doctor is specifically looking for, this material is side-tracked before it gets to his desk and filed in either his or his secretary's waste basket. As a matter of fact, so far as samples are concerned, I have a suspicion that many of them in doctor's offices are handled in exactly the same way. I do not know the answer to this problem. I suspect, however, that promotional leaflets and samples by mail constitute the least effective way of reaching the busy physician with information about your products.

Theodore Caplow in *Harvard Business Review* (November-December, 1952) following an extensive study reports some very significant trends that might be summed up as follows:

1. Less than 50 per cent of the doctors read their medical journals in any regular, systematized manner.

2. Doctors are now receiving almost three hundred pieces of direct mail advertising per month—a 100 per cent increase over 1940. About 62 per cent of this mail is opened and inspected to some limited extent by the doctor; the other 38 per cent is thrown away, opened or unopened, or examined by the doctor's nurse or secretary.

This survey shows that the attitude of the physician toward direct mail advertising is very much less favorable than it used to be. In about 38 per cent of the cases, physicians are resentful to some degree to direct mail advertising. This does not suggest that direct mail advertising in unproductive or unprofitable, but the tonnage and, in most instances, the duplication is terrific. Physicians sometimes receive ten or fifteen mailing pieces in a day or two on the same product under different trade names.

The detail man is also involved in this trend, and here we see the marketing power of personal contacts when those contacts are properly made and developed. Forty-seven per cent of the doctors interviewed were favorably disposed to detail men, but there is an increasing resentment by the better doctors against the detail man who just drops in and has no real, genuine, important, valuable message.

Also a recent report prepared under the auspices of the American Medical Association and presented as a service to the Pharmaceutical Manufacturers' Association and entitled *Attitudes of U.S. Physicians toward the American Pharmaceutical Industry* presents well-documented evidence that much of the promotional literature sent them is excessive and of doubtful value. Further, most of the physicians interviewed in the survey stated that their reactions to offers of cocktail parties, barbecues, hunting and fishing trips, and similar social affairs had no effect on their choice of a brand of pharmaceuticals. In short, it's my opinion that the Madison Avenue boys are selling the pharmaceutical manufacturers a bill of goods that isn't responsible for goods being sold. To assume that the pharmaceutical business is booming because of effective promotional literature is in my opinion fallacious reasoning. Just because there are many Methodist missionaries in Uganda and Uganda is consuming large quantities of whisky is no indication that the missionaries are drinking whisky.

Mr. Clarence M. Van Kirk, speaking as Vice President of E. R. Squibb and Sons, thoughtfully makes the following conclusions:

> Sound marketing policy in our industry, today as yesterday, springs from a very deep awareness of the emotional tides that ebb and flow in the hearts and minds of men, and knowledge and understanding of the factors in human behavior is the foundation for this awareness, and those who fail to dig deep into these fundamentals are sometimes persuaded to believe that shenanigans in the marketplace will substitute. . . .
>
> It is probably only through sound marketing individualism and character that companies acquire stature and respect and dignity and permanence.

Sound marketing individualism and character can come only through intelligent representation of the pharmaceutical industry by pharmaceutically trained detail men. Pharmaceutically trained detail men can be obtained if they are paid enough and given the status they deserve (re: Parke, Davis and Lilly). The future health of the world looks to the United States for leadership. The distinction of that leadership will be intimately bound to the ability of pharmaceutical manufacturers to place in the hands of pharmacists and physicians the drugs they need. The most effective link the manufacturer has with the prescription pharmacist and the physician is the detail man. Upon the strength of that link much depends. It is the responsibility of pharmaceutical educators to supply strong links. It is the responsibility of pharmaceutical manufacturers to recognize the need for that strength.

Melvin R. Gibson

ANNOUNCEMENTS

Pan-American seminar. Dr. Melvin W. Green, Chairman of the Committee on Education of the Pan-American Federation of Pharmacy and Biochemistry, recently announced the preliminary program for the Pan-American Seminar on Pharmaceutical Education to be held in San Juan, Puerto Rico, October 11-16, 1959. This seminar is an outgrowth of a recommendation for such a seminar made by the Fourth Pan-American Congress of Pharmacy and Biochemistry in Washington, D.C. in 1957. The objectives of the seminar are 1. To determine the importance and the extent of basic science subjects believed to be necessary in a modern pharmaceutical curriculum, 2. To explore the trends in the professional curricula with respect to the five principal areas of pharmacy (pharmaceutics), pharmaceutical chemistry, pharmacognosy, pharmacology, and pharmacy administration, 3. To study the extent and scope of public health education in pharmacy, 4. To discuss ways of establishing curricula that will strengthen the background of those students who desire to go into phases of professional practice, such as hospital pharmacy, manufacturing pharmacy, and medical service representation, 5. To discuss some of the principal pedagogical methods that make it possible to implement curricula, 6. To find ways of encouraging research and scholarship in pharmacy and the ancillary sciences in the pharmaceutical faculties throughout the American nations.

Details regarding the seminar will be sent to the schools from Dr. Green's office. The preliminary program is as follows:

Sunday Afternoon, October 11

1. Welcome from various people representing the Commonwealth, the College of Pharmacy, the Colegio, the Federation.
2. "The Objectives and Future Plans of the Pan-American Pharmaceutical and Biochemical Federation."
3. "Statement of Aims of the Seminar."
4. Reception and Cocktail Party.

Monday Morning, October 12

Objectives of Pharmaceutical Education

1. "Current Objectives of Pharmaceutical Education."
2. "The Importance of Pharmacology in Meeting the Objectives of Modern Pharmaceutical Education."
3. "The Importance of Pharmacognosy in Meeting the Objectives of Modern Pharmaceutical Education."

Monday Afternoon

Races, celebrating Discovery Day.

Monday Evening

1. "The Importance of Pharmaceutical Chemistry in Meeting the Objectives of Modern Pharmaceutical Education."
2. "The Importance of Biochemistry and Bromatology in Meeting the Objectives of Modern Pharmaceutical Education."

Tuesday Morning, October 13

Objectives of Pharmaceutical Education Continued

1. "The Importance of Pharmacy in Meeting the Objectives of Modern Pharmaceutical Education."
2. "The Importance of Pharmacy Administration in Meeting the Objectives of Modern Pharmaceutical Education."

Tuesday Afternoon

Prerequisites to Professional Education

1. "The Basic Physical Sciences as Prerequisites to Pharmaceutical Education."
2. "The Basic Biological Sciences as Prerequisites to Professional Pharmaceutical Education."

Wednesday Morning, October 14

Factors Involved in the Improvement of Teaching

1. "The Usefulness of Graduate Education in the Preparation of Teaching Personnel."
2. "The Role of Research in Improving the Quality of Teaching."
3. "Methods Employed in the Orientation of New Teachers."

Wednesday Afternoon

1. "The Objectives and Planning of Laboratory Work for the Instruction of Pharmacy Students."
2. "Hospital and Industrial Pharmacy as Areas of Specialization in Pharmaceutical Education."

Thursday Morning, October 15

The Pharmacist and Public Health

1. "International Health in the Americas."
2. "The Role of Public Health Courses in the Pharmacy Curriculum."
3. "The Pharmacist as a Health Educator."

Thursday Afternoon

A Visit to the University of Puerto Rico and the College of Pharmacy.

Friday Morning, October 16

1. "Historic and Sociologic Aspects of Pharmaceutical Education."
2. "The Value of Associations of Colleges of Pharmacy."
3. "Pharmaceutical Education Faces the Future."
4. "Conclusions and Accomplishments of the Seminar."

Friday Afternoon

Picnic and Beach Party.

Friday Evening

Farewell Banquet

LETTERS

AMERICAN JOURNAL OF
PHARMACEUTICAL EDUCATION
April 14, 1959

Dean H. G. Hewitt
Chairman, Executive Committee
American Association of
Colleges of Pharmacy
School of Pharmacy
University of Connecticut
Storrs, Connecticut

Dear Dean Hewitt:

With this letter I wish to submit my resignation as Editor of the *American Journal of Pharmaceutical Education* effective no later than December 31, 1960. At that time I will have completed five years in this position.

I should like to suggest that my successor be chosen no later than May, 1960, so that he may have the opportunity to plan properly the early issues of 1961 and to find a suitable printer. The State College of Washington Press does not wish to be considered as a printer subsequent to my resignation.

Sincerely,
(Signed)
Melvin R. Gibson
Editor

cc. President Louis C. Zopf
Secretary-Treasurer, George L. Webster
mrg/o

It is one thing to organize existing knowledge and current practices. It is quite a different thing to provide leaders who will blaze new trails and create new understanding.

Alpheus W. Smith, Am. J. Pharm. Ed., 8, 160 (1944)

MEMORIALS . . . . . .

WILLIAM A. PEARSON

It was with genuine and heartfelt regret that his colleagues, students, and friends at Ferris Institute learned of the death of Dr. William A. Pearson on February 15. 1959.

Dr. Pearson was born on April 6, 1879, in Van Wert, Ohio, where he spent his early years and completed his secondary education. Subsequently, his family moved to Ann Arbor, Michigan, where he continued his schooling, graduating from the University of Michigan with a Ph.C. degree in 1900. He successfully completed the State Board of Pharmacy examination and worked in a retail pharmacy until 1901, at which time he accepted a position with Parke, Davis and Company as research chemist. Realizing his need for further education, he enrolled for additional course work at the University of Michigan in bacteriology, physiological chemistry, and organic analysis, at the conclusion of which he once again rejoined Parke, Davis and Company.

In 1904 through the encouragement of Woodbridge N. Ferris, Founder and President of Ferris Institute, Dr. Pearson joined the staff as Dean and Instructor in Pharmacy and Chemistry at Ferris Institute. He remained in this position until 1906 when he and his wife, the former Mary Lonworth, moved to Philadelphia where he accepted the position of chief chemist for the Smith Kline & French Company. In addition to these duties he also accepted a part-time position as professor of chemistry at Hahnemann Medical College in 1907. Because he enjoyed the contacts with students, he resigned his position at Smith Kline & French Company in 1912 and assumed teaching duties at Hahnemann Medical College, becoming Dean in 1914, a position that he held until his resignation in 1944. While fulfilling his administrative duties, he also completed his medical training, obtaining the Doctor of Medicine degree from Hahnemann Medical College in 1916. Some years later he was awarded the Doctor of Philosophy degree by the Philadelphia College of Pharmacy.

In appreciation of the contributions which Dr. Pearson made to education and his untiring efforts as Dean of Hahnemann Medical College, that institution awarded to him the honorary LL.D. degree. He also received the honorary Sc.D. degree from La Salle College.

After his retirement in 1944, Dr. Pearson devoted full time to his work in chemistry, which had always been his field of greatest interest. However, some five years later, the institution at which he began his teaching career contacted him to return as Professor of Biochemistry and Physiology. It had always been his desire to conclude his teaching years at the college where he began, so in 1949 Dr. Pearson returned to the teaching staff at Ferris Institute. Being an ardent admirer of Mr. Ferris and an exponent of his philosophy of education, Dr. Pearson brought to this college the same selfless devotion that had characterized its founder. Until his final retirement in 1957, he gave of himself unstintingly, which resulted in the utmost admiration and respect by students and faculty alike.

In addition to all his activities relating to education, Dr. Pearson also found time for participation in community affairs. In his earlier years he was active in instrumental groups, playing the guitar and banjo. He was an accomplished athlete and an excellent tennis player, in which sport he actively participated until a leg injury in later years prevented it. He was president of the American Institute of Homeopathy, Governor of the Philadelphia Rotary district (the largest Rotary district in the world), served in the Volunteer Medical Corps during World War I, and served in the United States Navy orientation course and with the State Council of Defense, Commonwealth of Pennsylvania, during World War II.

Dr. Pearson will always be remembered as an able teacher, accomplished author, dynamic speaker, trusted counselor, and valued friend by his colleagues and many students at Ferris Institute.

Clark A. Andreson

NEW LITTLE PEOPLE . . . . . .

Mark Wayne Gardner—born April 21, 1959, to Mr. and Mrs. Vincent R. Gardner, University of California.

Howard Dana Fikrat—born April 20, 1959, to Dr. and Mrs. Hikmat T. Fikrat, University of California.

Nanette Susan Nuessle—born June 23, 1959, to Dr. and Mrs. Noel O. Nuessle, University of Kansas City.

Brian Boenigk—born January 25, 1959, to Dr. and Mrs. John Boenigk, University of Pittsburgh.

Joseph David McEvilla, Jr.—born May 30, 1959, to Dr. and Mrs. Joseph D. McEvilla, University of Pittsburgh.

Harry George Cocolas—born December 3, 1958, to Dr. and Mrs. George H. Cocolas, University of North Carolina.

David Ross Kanig—born December 13, 1958, to Professor and Mrs. Joseph L. Kanig, Columbia University.

Leslie Ann Chase—born May 5, 1959, to Dr. and Mrs. Grafton D. Chase, Philadelphia College of Pharmacy and Science.

James Scott Martin—born January 27, 1959, to Mr. and Mrs. Bruce D. Martin, University of Illinois.

Timothy Allan Morris and **Todd Andrew Morris**—born May 16, 1959, to Dr. and Mrs. Ralph W. Morris, University of Illinois.

Karen Beth Siegel—born May 11, 1959, to Dr. and Mrs. Frederick P. Siegel, University of Illinois.

Diplomats and governments, in the long run, can agree to only those things their people will support.

Milton S. Eisenhower, Am. J. Pharm. Ed., 8, 298 (1944)

STAFF CHANGES

NEW STAFF MEMBERS

Butler University. Dr. Howard Swartz, formerly of the University of Manitoba staff, has been appointed assistant professor of biochemistry effective September, 1959.

Alabama Polytechnic Institute. Dr. Samuel T. Coker, formerly associate professor of pharmacology at the University of Kansas City, resigned that position to become dean of the School of Pharmacy.

North Dakota Agricultural College. Dr. Wayne Kessler will join the staff as assistant professor of pharmaceutical chemistry in September.

Oregon State College. Dr. Harry Wayne Schultz has been appointed assistant professor of pharmaceutical chemistry effective in April. Dr. Schultz recently received his Ph.D. from the University of Iowa.

University of Colorado. Dr. Maurice C. Andries has been appointed associate professor of pharmacognosy. Dr. Andries was formerly on the Drake University staff.

Northeast Louisiana State College. Dr. August G. Danti has been appointed associate professor of pharmacy. Dr. Danti was formerly on the Wayne State University staff.

University of North Carolina. Dr. A. M. Goodeve has been appointed assistant professor of pharmacognosy. Dr. Goodeve received his Ph.D. from Purdue University. Dr. J. L. Brannon has been appointed assistant professor of pharmacy. Dr. Brannon received his Ph.D. from the University of Kansas.

Columbia University. Dr. Roger Mansevinus has been appointed assistant professor of pharmacology. Dr. Mansevinus received his Ph.D. in pharmaceutical chemistry from Purdue University and has done postdoctoral work in the Yale University Department of Pharmacology. Miss Lena DeLisser has been appointed instructor in pharmaceutical chemistry. Miss DeLisser received her M.S. degree from Columbia University.

Drake University. Dr. Wendell Southard has been appointed assistant professor of pharmaceutical chemistry. Dr. Southard recently received his Ph.D. in biochemistry from the University of Illinois.

University of Toledo. Dr. Howard Carl Ansel has been appointed to the staff. He recently received his Ph.D. from the University of Florida.

Purdue University. Mr. B. G. Dunavant, radiobiologist, has been appointed assistant professor of health physics in the new Department of Bionucleonics. Dr. William F. Bousquet will be assistant professor of bionucleonics research in this department.

University of Tennessee. Dr. Thomas Howard, graduate of Auburn School of Veterinary Medicine, joined the staff July 1 as assistant professor of pharmacy to teach veterinary pharmaceutical products and to do part-time research. Dr. Martin E. Hamner has been appointed professor of pharmacy and head of the Department of Pharmacy effective July 1. Dr. Hamner was formerly an associate professor on the staff of Southwestern State College. Mr. Grover C. Bowles, Chief Pharmacist of Baptist Memorial Hospital, has been appointed associate professor of hospital pharmacy in charge of hospital internship programs.

Rutgers—The State University. Dr. Marie Theresa Spoerlein has been appointed assistant professor of pharmacology. Dr. Spoerlein was formerly employed as a pharmacologist for the Schering Corporation.

University of Texas. Mr. Luther Ray Parker has been named director of the University of Texas Pharmacy Extension Service. Mr. Parker will be a lecturer in pharmacy and assistant to Dean Henry M. Burlage. Mr. Parker received his Bachelor of Science degree from the University of Texas and was store manager of Dougherty's Pharmacies in Dallas prior to accepting this new position.

CHANGES IN STAFF TITLES

University of California. Dr. John J. Eiler resigned his position as associate dean and chairman of the Department of Pharmaceutical Chemistry effective July 1, 1959, to pursue his research and scholarly interests.

University of Wyoming. The title of Mr. LeRay J. Anderson has been changed effective July 1, 1959 from assistant professor of pharmacy (supply) to assistant professor of pharmacy.

University of Pittsburgh. Dr. Mario Aceto has been promoted from instructor of pharmacology to assistant professor. Mr. Norman R. Farnsworth has been promoted from instructor of biological sciences to assistant professor.

Oregon State College. Dr. Leo A. Sciuchetti has been promoted from associate professor of pharmacognosy to professor.

University of Colorado. Dr. Tony E. Jones has been promoted from assistant professor of pharmaceutical chemistry to associate professor.

Columbia University. Professor Samuel S. Liberman has been appointed associate dean for student affairs effective July 1, 1959. In his new position, Professor Liberman will direct all college of pharmacy services concerned with admissions, counseling, and student activities.

University of Washington. Dr. E. M. Plein has been given the title of Professor of Pharmacy and Coordinator of Pharmaceutical Services. His additional duties involve scheduling the senior dispensing students into clinical assignments at the Teaching Hospital Pharmacy and the University Infirmary Pharmacy. He will continue directing the work of the Drug Service Department. Mr. Willard Jue is the new supervisor of the College of Pharmacy Drug Garden. Mr. Jue replaces Dr. Walter R. Naumann who has retired.

State College of Washington. Dr. Charles F. Martin has been promoted from associate professor of pharmaceutical chemistry to professor.

Purdue University. Dr. Alfred N. Martin has been promoted from associate professor of pharmacy to professor of physical pharmacy. Dr. John E. Christian who has been professor of pharmaceutical chemistry and head of the Department of Radiobiological Control has been named professor of bionucleonics and head of the new Department of Bionucleonics.

State University of Iowa. Mr. William W. Tester has been promoted from instructor and chief hospital pharmacist to assistant professor and chief hospital pharmacist.

. . . wherever slavery of any kind exists there exists the possibility, if not the inevitability, of violence.

Milton S. Eisenhower, Am. J. Pharm. Ed., 8, 307 (1944)

GENERAL NEWS

AFPE awards. The American Foundation for Pharmaceutical Education Board of Grants announced the awarding of $133,000 for graduate fellowships for the 1959-60 year. The Board also allocated $25,000 for undergraduate scholarships in colleges of pharmacy for the 1959-60 year. Members of the Board of Grants are: A. J. Brumbaugh; Daniel Z. Gibson; Robert Lincoln McNeil; Ernest H. Volwiler; and Ernest Little, Chairman. The graduate fellows are listed below:

Pharmacognosy

Ralph N. Blomster (Univ. of Connecticut)

Pharmaceutical Chemistry

Merle E. Amundson (Massachusetts Coll. of Pharmacy)
Leo W. Brown (Univ. of Washington)
Gerald A. Bruno (Purdue Univ.)
Charles E. Byrne (Univ. of Kansas City)
Melvin Chaiet (Univ. of Maryland)
Mei-Fong Chen (Massachusetts Coll. of Pharmacy)
Charles S. Davis (Purdue Univ.) Charles J. Lynn Memorial Fellow
Byron C. Fagg (Univ. of Washington)
Allen F. Hirsch (Univ. of North Carolina)
George N. Holcomb (Purdue Univ.)
Howard L. Johnson (Univ. of California)
Donald J. Lamb (Ohio State Univ.) E. Mead Johnson Memorial Fellow
Irwin Lippmann (Univ. of Michigan)
Peter E. Manni (Univ. of Rhode Island)
Joseph E. Moody, Jr. (Univ. of Connecticut)
John L. Neumeyer (Univ. of Wisconsin)
Karl A. Nieforth (Purdue Univ.)
Linda K. Rames (South Dakota A & M)
William C. Roemer (Purdue Univ.)
Oreste L. Salerni (Medical Coll. of Virginia)
Edwin G. Scheuer, Jr. (Univ. of Rhode Island)
Stanley M. Shaw (Purdue Univ.)
Murray C. Spear (Univ. of Maryland)
Jeremiah B. Sullivan (Univ. of Washington)
Bobby T. Thompson (Univ. of Mississippi)
Frederick Tishler (Univ. of Michigan)
Robert A. Wiley (Univ. of California)
Henry C. Wormser (Temple Univ.)

Pharmacology

Marvin M. Goldenberg (Temple Univ.)
Frank E. Green (Univ. of Florida)
Robert P. Halliday (Univ. of Pittsburgh)
Kent R. Hornbrook (Univ. of Michigan)
Zola P. Horovitz (Univ. of Pittsburgh)
Carl C. Hug, Jr. (Univ. of Michigan) Josiah Kirby Lilly Memorial Fellow
Robert C. Lanman (Univ. of Minnesota)
Howard McClain, Jr. (Univ. of Minnesota)
David A. McClure (Oregon State Coll.)
Patrick W. Ragozzino (Univ. of Connecticut)
Jacob Rothwacks (Ohio State Univ.)
Nick G. Strovilas (Ohio State Univ.)
Robert E. Taylor, Jr. (Univ. of Florida) Sydnor Barksdale Penick Memorial Fellow
Nathan Watzman (Univ. of Pittsburgh)
Jack K. Wier (Univ. of Washington)

Pharmacy

Stephen G. Bjaastad (Univ. of Washington)
Jacob Cohen (Iowa State Univ.)
Robert M. Cohn (Columbia Univ.)
Martin L. Eichman (Univ. of Washington)
Wayne M. Grim (Univ. of Michigan)
Arthur R. Hurwitz (Temple Univ.)
Gerald J. Jackson, Jr. (Univ. of Connecticut) Sydnor Barksdale Penick Memorial Fellow
James C. King (Univ. of Texas)
John A. Lott (Rutgers Univ.)
James C. Price (Univ. of Rhode Island)
Earl W. Seugling, Jr. (Ohio State Univ.)
Margaret A. Shaw (Univ. of Florida)
Anthony P. Simonelli (Univ. of Wisconsin)
William E. Smith (Univ. of Michigan)
Theodore D. Sokoloski (Univ. of Wisconsin)
Paul E. Wray (Univ. of Wisconsin)

Business Administration

Jack L. Cross (Ohio State Univ.) Charles R. Walgreen Memorial Fellow
Dale W. Doerr (Purdue Univ.)
Vincent R. Gardner (Univ. of California)
Juanita P. Horton (Univ. of Alabama)
Hugh F. Kabat (Univ. of Colorado)
James E. Moore (Butler Univ.)
Richard A. Ohvall (Univ. of Wisconsin)
Max Polinsky (Univ. of Wisconsin) Charles R. Walgreen Memorial Fellow

Manufacturing Pharmacy
Travis N. T. Olson (Univ. of Minnesota) H. A. B. Dunning Memorial Fellow
John Windt, Jr. (Temple Univ.)

Physical Pharmacy
Arge Drubulis (Univ. of Wisconsin)
Ernest C. Foernzler (Purdue Univ.)

Hospital Pharmacy
Henry J. Derewicz (Univ. of Michigan)

Biochemistry
Lester G. Bruns (St. Louis Univ.)

Botany
Taylor E. Lindhorst (Washington Univ., St. Louis)

Physiology
Leon D. Prokop (St. Louis Univ.)

Nobles receives fellowship. Dr. W. Lewis Nobles, Professor of Pharmacy, University of Mississippi, has received the Gustavus A. Pfeiffer Postdoctoral Memorial Research Fellowship for the 1959-60 academic year. His studies will be carried out at the University of Mississippi.

Newcomb awards. The American Foundation for Pharmaceutical Education recently announced the winners of the 1958 Edwin Leigh Newcomb Awards in pharmacognosy. The awards are: Undergraduate student—Robert E. Brummett, Oregon State College, for his essay "The Pattern of Growth and Alkaloid Biogenesis in *Datura stramonium* L. under the Influence of Gibberellic Acid." Graduate student—Dr. Ikram Hassan and Dr. Marin S. Dunn, Philadelphia College of Pharmacy and Science, for the essay "Studies of the Genus *Thymus*." Teacher-researcher—Dr. Virginia L. Bailey, Wayne State University, for the essay "Studies in the Genus *Ptelea*." These awards will be presented at the 1959 meeting of the Plant Science Seminar.

Daniels travels. On June 1, Dean T. C. Daniels, University of California, returned from a two-month trip to the Orient and Hawaii. He was guest lecturer at the annual meetings of the Japanese Pharmaceutical Association and Pharmaceutical Society of Japan, in which he was made an honorary member. Dean Daniels also lectured at a number of schools including the Universities of Kyoto, Tokushima, Shizuoka, and Kyoritsu (Women's College). While in Japan, he also visited most of the large pharmaceutical manufacturers. In the Philippines he lectured at Santo Tomas University. Dean Daniels on his return from the Orient gave two seminars at the meetings of the Hawaiian Pharmaceutical Association.

California speakers. Guest speakers at the graduate seminars in pharmaceutical chemistry at the University of California included Dr. P. J. Deoras, Haffkine Institute, Bombay, on "Studies on Poisonous Snakes in India," and Dr. J. Cymerman Craig, Senior Lecturer in Organic Chemistry, University of Sydney, who spoke on "Oxytocic Activity in Simplified Analogs of Lysergic Acid" and "The Structure and Anti-tuberculous Activity of Aromatic Amines—A Physical-Organic Approach."

Johnson receives grant. Dr. William E. Johnson, University of Wyoming, has received a research grant of $2,850 from the National Institutes of Health to continue research activities on the pharmacology of a series of beta-(2 furyl) alkylamines. Dr. Raymond J. Kahl and Dean W. O'Day are collaborating with Dr. Johnson on this project.

Butler Rho Chi Lectureship. On May 11, 1959, the Alpha Phi Chapter of Rho Chi Pharmacy Honor Society held the first in a series of annual lectures on the Butler University Campus. Dr. Chauncey D. Leake, President-Elect of the AAAS, delivered the inaugural lecture. It was attended by students, prominent scientists in the area, representatives of other honor organizations, and members of the faculties of colleges in the vicinity of Indianapolis. The establishment of the lectureship was made possible by the Rho Chi Chapter Award which was won by Alpha Phi in 1958.

Butler receives grant. An NSF grant of $3,880 has been received by Butler University College of Pharmacy for undergraduate research participation for five students.

Hubbard resigns. Dr. Dorothy Hubbard resigned from the Butler University staff to do full-time research in biochemistry at the Indiana University Medical Center.

Meyers and Martin to study. Dr. Donald B. Meyers, Associate Professor of Pharmacology, and Dr. John W. Martin, Associate Professor of Pharmaceutical Chemistry, of Butler University will take part in a four-week course in radioisotope techniques at the Oak Ridge Institute of Nuclear Studies.

Tuckerman assignment. Dr. Murray Tuckerman, Associate Professor of Chemistry, Temple University, served as a research associate during the summer months, 1959, at the Argonne National Laboratories, Chicago.

Elkin receives grant and honor. Dr. Samuel Elkin, Assistant Professor of Chemistry, Temple University, has been awarded a grant by the National Institutes of Health to support study of a new series of indole derivatives having local anesthetic properties. Dr. Elkin was honored by the Galen Alumni Chapter of Rho Pi Phi International Fraternity as "Man of the Year" at a testimonial dinner June 7, 1959.

Buckley and Kinnard receive grant. Dr. Joseph P. Buckley and Dr. William J. Kinnard, University of Pittsburgh, have received a three-year $41,467 grant from the National Institutes of Health for research on the evaluation and pharmacology of psychotropic agents.

Blake takes leave. Dr. Martin Blake, North Dakota Agricultural College, is taking a leave of absence for the 1959-60 year to be a resident research associate at the Argonne National Laboratories.

Galysh resigns. Dr. Fred Galysh, Professor of Pharmacology, North Dakota Agricultural College, has resigned to become senior pharmacologist with Baxter Laboratories in Chicago.

North Dakota grants renewed. Research grants from Rowell Laboratories and the North Dakota Heart Association to the School of Pharmacy of North Dakota Agricultural College have been renewed for the 1959-60 year.

NSF grants. Two National Science Foundation grants have been received by the North Dakota Agricultural College School of Pharmacy. Work on the analysis of volatile oils and the effects of radiation on peppermint oil plants is being supported by these grants.

Sciuchetti receives grant. A special grant of $5,580 has been received by Dr. Leo A. Sciuchetti of Oregon State College to conduct an "Undergraduate Research Participation Program" in the sciences. The object of this grant, which came from the National Science Foundation, is to determine through a large-scale and broadly based trial whether providing superior undergraduate students with experience in research participation under the direction of college faculty members can make an important contribution to science education. Six Oregon State College pharmacy students were selected as participants. Each student enrolled in the summer session for twelve credits of pharmacognosy research and will be paid $528. The grant also includes payment of the students' summer session fees and provides necessary supplies. The research is on the influence of gibberellic acid on the growth and alkaloid biogenesis in various medicinal plants.

MCP student employment. In June the undergraduate Massachusetts College of Pharmacy student labor force numbering nearly 400 was available to pharmacy in New England for full-time employment during the summer months. The importance of this group in relieving the critical manpower shortage in pharmacy can be estimated best by an examination of the data compiled by the College Placement Bureau. For the period June to September, 1958, 467 students, or 95 per cent of those reporting, were employed an average of forty-four hours a week for fourteen weeks, a total of nearly 290,000 hours. Total earnings for the group were $333,500, or some $100,000 more than the combined tuition and other fees of all the students in the College. The nature of their employment varied from aluminum cutting to wood refinishing, but the percentage of those employed in pharmacy ranged from 54 per cent for freshmen to 85 per cent for seniors. Average summer earnings for each of the four classes were as follows: freshmen, $611; sophomores, $730; juniors, $830; and seniors, $920. It is interesting to note that for a similar period twenty years ago, 334 students reported total earnings of $53,000.

Colorado recognizes Kohler. Mr. Fred W. Kohler, a leading Colorado pharmacist of Colorado Springs, received the University of Colorado School of Pharmacy Distinguished Service Award at the June commencement. Mr. Kohler is a 1933 graduate of the University. He opened the first professional pharmacy in Colorado Springs in 1936, was chief pharmacist of the Mare Island Naval Hospital during World War II, was a member of the Colorado State Board of Pharmacy for twelve years, and is active in all state and national pharmaceutical organizations.

MCP has record refresher course enrollment. Massachusetts College of Pharmacy enrolled a record number of 346 practicing pharmacists in its twentieth annual refresher course held at the College during the first two weeks in May on Tuesday and Thursday evenings.

New publication. Academic Press, Inc. has announced the release of a new publication entitled *Biochemical and Biophysical Research Communications.* Beginning in July approximately six issues will be released between July and December, 1959. It is expected that communications will be published within two to four weeks after acceptance. Subscription price for Volume I is $12.00 for institutional subscribers and $6.50 for subscribers certifying that the publication will be for their personal use.

Bouvet honored. The American Institute of the History of Pharmacy announces that the fifth Urdang Medal has been conferred upon Maurice Bouvet, pharmacist-historian of Paris. The seventy-four-year-old Parisian was cited particularly for his definitive book on the development of pharmacy in France *Histoire de la Pharmacie en France des Origines à Nos Jours,* Paris, 1936, 445 pp., as well as his monographic research on such topics as the French health professions during the American Revolution and the history of hospital pharmacy. Dr. Alex Berman of the University of Michigan presented the medal at a ceremony held at a

meeting of the French Society for the History of Pharmacy at the School of Pharmacy of Paris. Dr. Berman is in Europe as a Guggenheim Fellow.

Brooklyn offers course. Brooklyn College of Pharmacy from October 7 to November 25 will offer a postgraduate, noncredit course in pharmacology in eight Wednesday night lectures. The course is designed for practicing pharmacists, medical service representatives, research personnel, nurses, and chemists. It will be conducted by Dean Arthur G. Zupko, Dr. James W. Ingalls, and Dr. Shirley D. Kraus. Each participant will be given a complete set of mimeographed lecture notes, about 300 pages. The fee for the entire series probably will be $16.50.

Colorado offers new degree. Effective this fall the University of Colorado College of Pharmacy will offer a new degree—Master of Science in Hospital Pharmacy. General hospitals in the region, including Denver General, St. Luke's Hospital in Denver, and Glockner-Penrose Hospital in Colorado Springs, are offering residencies as part of the program.

North Carolina building nearing completion. It is anticipated that the new North Carolina pharmacy building will be completed to allow use early in the fall semester.

New England honorary degrees. New England College of Pharmacy awarded honorary doctor of science degrees to Justin W. Dart, President of the Rexall Drug and Chemical Company; Charles A. Berman, Secretary of the New England College of Pharmacy Board of Trustees; and John E. Powers, President of the Massachusetts State Senate, on June 7, 1959.

Goodrich retires. Dr. F. J. Goodrich has retired completely from his teaching duties in the College of Pharmacy at the University of Washington. Dr. Goodrich will have the title Dean Emeritus and plans to retain an office at the University to continue his writing and research.

Hall to Malaya. Dr. Nathan A. Hall, Associate Professor of Pharmacy, University of Washington, has been granted a leave for the 1959-60 academic year to accept a Fulbright grant which will take him to the University of Malaya in Singapore. Dr. Hall will lecture in the college of pharmacy and conduct researches on some of the native plants used as medicines. His children will accompany him.

Huitric receives grant. Dr. Alain C. Huitric, Assistant Professor of Pharmaceutical Chemistry, University of Washington, has received a $20,000 grant from the U.S. Public Health Service. The funds will be used for research in the synthesis, steriochemistry, and stereospecificity of cardioplegic agents.

Hager in Mississippi. Dean George P. Hager of the University of Minnesota addressed the Mississippi State Pharmaceutical Association Convention on June 16 on the topic "The Role of the Pharmacist and his Stake in Pharmaceutical Education."

White receives grant. Dr. Allen I. White, Professor of Pharmaceutical Chemistry, State College of Washington, has received a grant from the U.S. Public Health Service of $13,800 a year for three years to continue research on analgesic activity studies of the amino tetralins.

Sarett honored. Dr. Lewis H. Sarett, Director of Synthetic Organic Chemistry, Merck, Sharp, and Dohme Research Laboratories, received the Philadelphia College of Pharmacy and Science Rho Chi Citation and delivered the Julius W. Sturmer Memorial Lecture May 6.

PCP honorary degrees. Philadelphia College of Pharmacy and Science on June 8 awarded honorary doctor of science degrees to Mr. John T. Connor, President of Merck and Company; Mr. Ralph T. Overman, Chairman of the Division of Special Training of the Oak Ridge Institute of Nuclear Studies; and Mr. Leander S. Stuart, Principal Bacteriologist of the Agricultural Research Service of the U.S. Department of Agriculture.

Purdue establishes new department. Purdue University School of Pharmacy has established a new Department of Bionucleonics. The new department will be responsible for a teaching function. At the present time five courses are offered to undergraduate and graduate students, and over 900 graduate students from various departments of the University have taken the courses during the last decade. The new department will be responsible for the radiological control function throughout the University, will pass judgment on all health hazards, approve projects that are established, and assist in the interpretation of results. It will be responsible for the coordination of bionucleonic research activities throughout the University. The department also gives special radioisotope instrumentation services such as liquid scintillation counting, serves as the liaison agency for the coordination of University-Argonne-Associated Midwest Universities relationships, and currently is engaged in a special study of the application of radioisotopes to the pharmaceutical industry. Dr. John E. Christian heads the new department. Mr. B. G. Dunavant, radiobiologist, will assume duties as assistant professor of health physics, and Dr. William F. Bousquet will be assistant professor of bionucleonics research. The new department will continue to occupy the space previously utilized for radiological control and instruction in the isotopes area. It will also take

over space previously occupied by the Department of Pharmacology. The latter has been moved to the Pierce Conservatory with separate quarters.

May resigns. Mr. Charles N. May has resigned as instructor of hospital pharmacy at the University of Tennessee to accept a position at the University of Georgia.

Accreditation manual published. The American Council on Pharmaceutical Education recently released the Sixth Edition of *Accreditation Manual* which will become official July 1, 1960. Copies are available from the Council. The Council is currently evaluating colleges of pharmacy on the basis of the Fifth Edition of the *Manual* which has been in effect since 1952. The new manual will provide suitable standards for the projected program of pharmaceutical education which is to extend over a period of five college years.

ACA honors Youngken and Zupko. At its New Orleans meeting the American College of Apothecaries elected two educators into fellowship: Dean Heber W. Youngken, Jr., University of Rhode Island College of Pharmacy, and Dean Arthur G. Zupko, Brooklyn College of Pharmacy.

Neimeth honored. Dr. Edward Neimeth, President of Brooklyn College of Pharmacy, was honored as retiring President of Maimonides Hospital of Brooklyn at a $100-a-plate dinner at the Waldorf Astoria, June 21. The proceeds will be used toward constructing an Edward Neimeth Institute for Medical Research at the hospital. Dr. Neimeth is President of the National Magnesia Company.

Long Island honors Nolen. At Long Island University's June 11 commencement at the Brooklyn Center campus, Dr. Herman C. Nolen, President of McKesson & Robbins, Inc., received the honorary Doctor of Laws degree.

Education courses for Brooklyn faculty. Dean Arthur G. Zupko of Brooklyn College of Pharmacy announced in May that a compulsory, ten-lecture course in educational methods would be offered in the month of June for faculty members. Dr. Jacob I. Hartstein, Dean of the Long Island University's Graduate School and Chairman of the Department of Education, conducted the course.

Arnette resigns. Mr. Joseph H. Arnette, formerly director of the University of Texas Pharmacy Extension Service, has resigned to become Texas State Board of Pharmacy secretary.

Bryan receives grant. Dr. Gordon H. Bryan, Montana State University, has received a grant of $825 from the Montana Heart Association for research in the role of sulfate fluxes in the isolated mammalian heart.

Deno recovering. Dr. Richard A. Deno, University of Michigan, is recovering satisfactorily from a coronary attack in May. This illness has necessitated the resignation of Dr. Deno from an educational exchange appointment from the U.S. State Department to serve as visiting professor of pharmacy at the University of Costa Rica for the summer. Dr. Deno had been scheduled to work with the staff of the school of pharmacy there in a study of the pharmaceutical education program.

Tice at Wisconsin. Dr. Linwood F. Tice, Associate Dean, Philadelphia College of Pharmacy and Science, presented the 1959 Kremers' Memorial Lecture at the University of Wisconsin, April 15. This was the ninth lecture of the annual series established by Eta Chapter of Rho Chi to honor the late Dr. Edward Kremers.

New AFPE fellowship. An annual fellowship honoring Mr. George V. Doerr has been established with the American Foundation for Pharmaceutical Education by his children and McKesson & Robbins, Inc. Mr. Doerr served as Vice President and Director of McKesson & Robbins from 1928 to 1945, and as First Vice President from 1945 until his retirement in 1954. Mr. Doerr is Honorary President of the American Foundation for Pharmaceutical Education and was one of its founders. He was a member of the Executive Committee from 1943 to 1953 and a Director from its founding in 1942 to 1953. Long interested in pharmaceutical education and the status of pharmacy among the professions, Mr. Doerr was active in the original fund raising for the Foundation which has supplied the means for advancing all phases of pharmaceutical education.

Texas receives grant. The University of Texas College of Pharmacy has received a grant of $9,753 from the Atomic Energy Commission with which to equip a laboratory for offering a course in radioactive isotopes for pharmacy majors. The course will be directed by Dr. E. H. Djao, Assistant Professor of Pharmacognosy, and Dr. Frank Cosgrove, Assistant Professor of Pharmacy, both of whom have studied at the Oak Ridge Institute for Nuclear Studies.

Shay receives grant. Dr. Donald E. Shay, Professor of Microbiology, University of Maryland, has had a renewal of his $7,000 Public Health Service Grant for the study of the transfer of pathogenic staphylococci.

Doorenbos speaks. Dr. Norman J. Doorenbos, Associate Professor of Pharmaceutical Chemistry, University of Maryland, was guest speaker at the annual initiation banquet of Rho Chi at Temple University on May 13.

SKF Foundation grants. The Smith Kline & French Foundation disbursed $1,240,-251 in grants to science, education, and charity during 1957 and 1958, it has been disclosed in a report released by the trustees of the organization.

This brought to $2,698,127 the amount given by the Foundation since its inception in December 1952. The amount disbursed in the last two years equals the $1,447,876 which was distributed during the previous four years.

Established by Smith Kline & French Laboratories, Philadelphia pharmaceutical firm, "for the more effective administration and distribution of the company's philanthropic contributions," the Foundation supports five major areas with its funds. These include direct grants for educational purposes, donations to combat mental illness, contributions to public charities and improvement, support for the purchase of scientific and educational equipment and construction, and awards in basic research in medicine and related sciences.

Direct grants for educational purposes during the two-year period amounted to $453,714, the largest portion of the disbursement. Most of these contributions were in the form of a large number of relatively small grants. For the most part these grants were unrestricted in nature. The educational grants also included $40,622 contributed by the Foundation under its "Matching Gifts for Education Program." This program allows the Foundation to match, up to $1,000 per year, the gifts which individual employees of Smith Kline & French Laboratories make to educational institutions.

Donations by the SK&F Foundation to combat mental illness during 1957 and 1958 amounted to $278,170. This included $63,333 given to the American Psychiatric Association under a three-year $100,000 grant for fellowships in psychiatry. The three-year grant is the second to be given by the Foundation to the APA. The first, made in 1954, was for $90,000.

The APA also received an additional $20,000 during the last two years to support remotivation training in mental hospitals as well as another $5,000 for psychiatric studies. Professional education in the mental health field also was supported with grants totaling $34,500. Other grants for a total of $67,287 were made to universities, clinics, and research institutions for teaching and fundamental research in psychiatry and related sciences.

The Foundation's contributions to public charities and community improvement amounted to $197,905 during the two year period. For the most part these contributions went to organizations in the greater Philadelphia area with Philadelphia's United Fund receiving $133,500. Other limited grants were made to various national voluntary health agencies and community organizations and to the nine community funds in cities where SK&F Laboratories have offices.

Organizations with specific need for equipment to advance their scientific or educational activities received $171,627 from the Foundation during the last two years. These included some thirty colleges and universities throughout the nation which were granted $141,877, most of which went for equipment used in the biological sciences. Contributions to building funds were restricted principally to teaching hospitals in the Philadelphia area and amounted to $29,750.

Basic research in medicine and related sciences received awards totaling $138,835 during the two year period. In noting the grants, the trustees pointed out the Foundation "has turned its primary emphasis from specific research projects carried on in medical institutions toward broader programs of research studies in liberal arts colleges" due to the recent large-scale increase in government funds for medical research. "In so doing," the trustees said, "we feel we are giving encouragement to potential investigators in basic science who do not normally compete effectively in the more medically oriented federal programs."

A yearly breakdown of SK&F Foundation disbursements shows $236,900 in 1953; $225,950 in 1954; $426,005 in 1955; $569,021 in 1956; $534,141 in 1957 and $706,110 in 1958.

The SK&F Foundation report is the second issued by the trustees who include Howard E. Morgan, Secretary-Treasurer; W. Furness Thompson, Vice President, Research & Development; and G. Frederick Roll, Director of Public Relations, all of Smith Kline & French Laboratories.

When the first report was issued, the Foundation Library Center, information clearing house in the field of charitable organizations, termed it "perhaps the very first" public accounting of any major corporation's philanthropic program. The current report is still a rarity in the field of charitable trusts.

The trustees in releasing the report said "an accounting of the Foundation's disbursements and a description of how it has helped advance the philanthropic objectives of its parent company may contribute to a more general understanding of the rapidly growing interest of corporations in philanthropy."

National

	1957	1958
Academy of Religion and Mental Health, New York, N.Y.	$10,000	$10,000
American Association of Colleges of Pharmacy, Iowa City, Ia.	1,000	
The American Child Guidance Foundation, Boston, Mass.	1,000	
American Foundation for Pharmaceutical Education, Washington, D.C.	5,000	5,000
American Friends of the Hebrew University, Inc., Brooklyn, N.Y.	2,500	
American Friends Service Committee, Inc., Philadelphia, Pa.	5,000	5,000
American Institute of the History of Pharmacy, Madison, Wisc.	250	250
The American Psychiatric Association, Washington, D.C.	30,000	58,333
American Society for Pharmacology and Experimental Therapeutics, Inc., Baltimore, Md.	2,000	2,000
Citizens Committee for the Hoover Report, New York, N. Y.		100
Committee for Economic Development, New York, N.Y.	500	1,000
Crusade for Freedom, Inc., New York, N.Y.	1,000	250
Group for the Advancement of Psychiatry, Chicago, Ill.		2,500
Health Information Foundation, New York, N.Y.	15,000	15,000
The Menninger Foundation, Topeka, Kan.		1,000
The National Association for Mental Health, Inc., New York, N.Y.	15,000	10,000
National Citizens Committee for the World Health Organization, Inc., New York, N.Y.		1,500
National Civil Service League, New York, N.Y.	150	150
National Fund for Medical Education, Inc., New York, N.Y.	12,500	15,000
National Information Bureau, Inc., New York, N.Y.	100	100
National League for Nursing, Inc., New York, N.Y.	6,000	
National Merit Scholarship Corp., Evanston, Ill.		2,500
National Safety Council, New York, N.Y.	100	100
National Society for Medical Research, Chicago, Ill.	500	500
Planned Parenthood Federation of America, Inc., New York, N.Y.	2,500	1,000
The Population Council, Inc., New York, N.Y.		1,500
Psychiatric Research Fund, Chicago, Ill.	1,000	
Tax Foundation, Inc., New York, N.Y.	100	
Tax Institute, Inc., New York, N.Y.	500	
United Negro College Fund, Inc., New York, N.Y.	1,000	1,000
World Medical Association-U.S. Committee, Inc., New York, N.Y.	3,000	
World Rehabilitation Fund, Inc., New York, N.Y.	5,000	10,000

Regional

Alabama—$6,905		
The Alabama Association for Mental Health, Inc., Birmingham	$ 1,500	
Alabama Polytechnic Institute School of Veterinary Medicine, Auburn		$ 5,405
California—$26,100		
College of Medical Evangelists, Loma Linda		2,600
College of the Pacific, School of Pharmacy, Stockton		3,500
Palo Alto-Stanford Community Chest, Palo Alto		500
Stanford University School of Medicine, Stanford	8,000	
United Bay Area Crusade, San Francisco	500	
University of California, Cardiovascular Research Institute, Berkeley		5,000
University of California Medical Center, Berkeley	5,000	
Welfare Federation of Los Angeles Area, Los Angeles	500	500
Colorado—$13,000		
University of Colorado School of Medicine, Boulder	13,000	
Connecticut—$12,000		
The Marine Historical Association, Inc., Mystic	500	500
New England Institute for Medical Research, Ridgefield		3,000
Yale University, New Haven		8,000
Florida—$5,500		
United Fund of Dade County, Miami		500
University of Florida College of Medicine, Gainesville		5,000
Georgia—$13,250		
Emory University, Emory	$8,250	
Southern College of Pharmacy, Atlanta		5,000

Illinois—$32,500		
Chicago Wesley Memorial Hospital, Chicago		8,000
Community Fund of Chicago, Inc., Chicago	500	500
Greenville College, Greenville		5,000
The Monmouth College, Monmouth		2,500
North Central College, Naperville		3,000
Northwestern University Medical School, Evanston	5,000	
The University of Chicago, Chicago		8,000
Indiana—$29,000		
Indiana Association for Mental Health, Indianapolis		10,000
Indiana University Medical Center, Bloomington	5,000	5,000
Purdue University, Lafayette	3,000	3,000
University of Notre Dame, South Bend		3,000
Iowa—$17,260		
Iowa State College of Agriculture and Mechanic Arts, Ames		5,000
State University of Iowa, Iowa City	2,000	10,260
Kansas—$10,000		
University of Kansas Medical Center, Lawrence		10,000
Louisiana—$7,500		
Louisiana State University, Baton Rouge	5,000	
Loyola University, New Orleans	2,500	
Maine—$1,187		
Roscoe B. Jackson Memorial Laboratory, Bar Harbor	1,187	
Maryland—$46,800		
Goucher College, Baltimore	4,000	4,000
The Johns Hopkins University, Baltimore	4,600	21,200
Loyola University, Baltimore		5,000
Sinai Hospital of Baltimore, Inc., Baltimore	8,000	
Massachusetts—$18,250		
Boston Committee on Alcoholism, Inc., Boston		250
Boston University School of Medicine, Boston	5,000	
Harvard University, Cambridge	2,500	
Marine Biological Laboratory, Woods Hole	3,000	3,000
The Massachusetts General Hospital, Boston		2,000
New England College of Pharmacy, Boston	2,500	
Michigan—$14,000		
Kalamazoo College, Kalamazoo		2,500
Lafayette Clinic, Detroit		5,000
University of Michigan College of Pharmacy, Ann Arbor		1,500
Wayne State University, College of Medicine, Detroit		5,000
Minnesota—$18,590		
St. Joseph's Hospital, St. Paul	7,590	
University of Minnesota, Minneapolis	3,000	8,000
Mississippi—$5,000		
University of Mississippi School of Medicine, University	$5,000	
Missouri—$19,100		
St. Louis College of Pharmacy and Allied Science, St. Louis		2,500
St. Louis University School of Medicine, St. Louis		8,000
University of Missouri School of Medicine, Columbia		600
Westminster College, Fulton	4,000	4,000
New Hampshire—$8,600		
Dartmouth College, Hanover		600
Dartmouth Medical School, Hanover		8,000
New Jersey—$32,640		
Camden Hospitals Improvement Enlargement Fund, Camden	5,000	
Rutgers University, New Brunswick	3,800	6,000
Seton Hall College of Medicine and Dentistry, South Orange	8,000	9,840

New York—$95,515		
Albany Medical College of Union University, Albany		6,500
The Buffalo General Hospital, Buffalo	8,100	
Colgate University, Hamilton		3,000
College of Mount St. Vincent, New York		900
Columbia University College of Physicians and Surgeons, New York	7,000	
Hobart and William Smith Colleges, Geneva		3,000
Keuka College, Keuka Park		6,000
Molloy Catholic College For Women, Rockville		1,000
New York Medical College, New York		8,000
New York University College of Medicine, New York		15,500
Polytechnic Institute of Brooklyn, Brooklyn	4,300	1,075
Roswel Park Memorial Institute, Buffalo	8,740	
Skidmore College, Saratoga Springs		3,500
State University of New York, Downstate Medical Center, Albany	1,200	
University of Buffalo School of Pharmacy, Buffalo		2,500
University of Rochester School of Medicine and Dentistry, Rochester	3,500	3,700
Yeshiva University, Albert Einstein College of Medicine, New York	8,000	
Ohio—$20,900		
The Children's Hospital Research Foundation, Cincinnati	5,000	
Columbus Psychiatric Institute, Columbus		3,000
The Ohio State University, Columbus	2,500	6,000
University of Cincinnati College of Medicine, Cincinnati		1,000
University of Cincinnati College of Pharmacy, Cincinnati		1,500
Western Reserve University, Cleveland	1,500	400
Oregon—$10,670		
Reed College, Portland		2,500
University of Oregon Medical School, Eugene		8,170
Pennsylvania—$370,229		
Academy of Music Centennial Fund, Philadelphia	2,500	
The Academy of Natural Sciences of Philadelphia, Philadelphia	5,000	
Albert Einstein Medical Center, Philadelphia	500	500
American Cancer Society, Inc., Philadelphia Division	100	100
American Chemical Society, Philadelphia Section	2,000	
American College of Physicians, Philadelphia	5,000	
Americans for the Competitive Enterprise System, Inc. Philadelphia	550	750
Boy Scouts of America, Philadelphia Council	1,500	1,500
Bryn Mawr College, Bryn Mawr		5,000
Bucknell University, Lewisburg		5,000
Bureau of Municipal Research and Pennsylvania Economy League, Philadelphia	1,500	1,500
The Committee of Seventy, Philadelphia	750	750
Crime Prevention Association of Philadelphia		500
Dickinson College, Carlisle		2,000
Drexel Institute of Technology, Philadelphia		3,000
Foundation for Independent Colleges, Inc., Harrisburg	2,500	2,500
Fountain House, Inc., Philadelphia	2,500	5,000
The Franklin Institute, Philadelphia	2,500	
Girl Scouts of Philadelphia, Inc., Philadelphia	1,750	
Greater Philadelphia Movement, Philadelphia	1,750	1,500
Hahnemann Medical College and Hospital of Philadelphia	1,200	9,700
Haverford College, Haverford	5,000	
Health and Welfare Council, Inc., Philadelphia		165
Holy Redeemer Hospital, Philadelphia	1,000	
Independent Schools' Fund of Philadelphia and Vicinity, Philadelphia	1,500	1,500
The Jefferson Medical College of Philadelphia		9,500
Marriage Council, Philadelphia	2,000	
Mental Health Association of Southeastern Pennsylvania, Philadelphia	4,800	2,500
Muhlenberg Medical Center, Allentown	2,500	
Nazareth Hospital, Philadelphia	2,500	
Pennsylvania Association for Retarded Children, Inc., Philadelphia	10,000	
Pennsylvania Citizens Association for Health and Welfare, Harrisburg	1,500	
Pennsylvania Hospital, Philadelphia	864	6,000
Pennsylvania Mental Health, Inc., Philadelphia	9,000	5,000
The Philadelphia Child Guidance Clinic, Philadelphia		5,000

Philadelphia College of Pharmacy and Science, Philadelphia	2,300	
Philadelphia Fellowship Commission, Philadelphia	150	150
Philadelphia Museum School of Art, Philadelphia		1,000
The Philadelphia Society for Crippled Children and Adults, Inc.	100	100
Philadelphia Tuberculosis and Health Association, Philadelphia	150	150
St. Francis College, Loretto		500
Swarthmore College, Swarthmore	2,000	
Temple University, Philadelphia	3,500	4,700
Thiel College of the Evangelical Lutheran Church, Greenville		2,500
United Fund of Allegheny County, Pittsburgh		500
United Fund of Norristown Area, Inc., Norristown		500
United Fund of Philadelphia, Philadelphia	67,500	66,000
University of Pennsylvania, Philadelphia	25,500	31,000
University of Pittsburgh, Pittsburgh		3,000
University of Scranton, Scranton		5,000
Wilson College, Chambersburg		2,500
The Wistar Institute of Anatomy and Biology, Philadelphia	5,000	
Woman's Medical College of Pennsylvania, Philadelphia	5,000	
Y.M.C.A. of Philadelphia	100	100
Rhode Island—$13,000		
Brown University, Providence		5,000
University of Rhode Island College of Pharmacy, Kingston		8,000
South Dakota—$1,000		
State University of South Dakota, Vermillion	1,000	
Tennessee—$17,150		
George Peabody College for Teachers, Nashville		4,150
Knoxville College, Knoxville		5,000
Meharry Medical College, Nashville	5,000	
The University of Tennessee College of Medicine, Knoxville	3,000	
Texas—$24,200		
Baylor University, College of Medicine, Waco	2,500	10,000
Community Chest of Greater Dallas, Inc., Dallas	500	500
The Methodist Hospital, Houston	6,700	
United Fund and Community Chest of Houston and Harris County, Houston	500	500
University of Texas, Austin		3,000
Utah—$6,000		
University of Utah College of Medicine, Salt Lake City	5,000	1,000
Virginia—$7,600		
Medical College of Virginia School of Pharmacy, Richmond		4,100
Virginia Polytechnic Institute, Blacksburg		3,500
Vermont—$5,000		
The University of Vermont College of Medicine, Burlington		5,000
Washington—$15,200		
University of Washington, Seattle	9,000	6,200
Wisconsin—$11,500		
University of Wisconsin, Madison		11,500

It seems to me that a basic confusion in American Education has been the confusion of an information service with an educational system.

Milton S. Eisenhower, Am. J. Pharm. Ed., 8, 308 (1944)

BOOK REVIEWS

Mono- and Sesquiterpenoids, P. de Mayo. Volume II in the series, **The Chemistry of Natural Products,** K. W. Bentley, Editor. Interscience Publishers, Inc., New York, New York, 1959. vii + 320 pp., 5 tbls. $7.50.

The first thought which enters one's mind on taking this book in hand is "how can so comprehensive a subject be consolidated into so small a book?" The answer is readily derived from the fact that the book is not a detailed accounting of the mono- and sesquiterpenoids; instead, it is a survey of recent literature in the field. Indeed, the vast majority of references are drawn from the last decade. In view of this, it would seem that a more appropriate title would be, "Recent Advances in the Chemistry of the Mono- and Sesquiterpenoids."

It is obvious that the recent literature has been covered with great thoroughness, but even the advanced student, for whom the book was most certainly intended, would appreciate greater documentation than the author offers. The extensive data are organized in a masterly fashion, and the author's expression of it is crisp and precise —few words are wasted. Specialists in the field will appreciate the ready availability of spectral absorption data (both UV and IR), molecular rotation data, reaction mechanisms, planar configurations and stereochemistry which are applied in studying the reactivity and the structure of the mono- and sesquiterpenoids which for many years have been regarded somewhat unpredictable in behavior.

Due to its fine organization, the book is extremely easy to study. Structural formulae, of which there are hundreds, are sharply and accurately diagrammed on the right-hand pages, opposite the discussion concerning them on the left-hand page. The organization itself follows a simple plan consisting of: the monoterpenoids, monocyclic monoterpenoids, bicyclic monoterpenoids, and the sesquiterpenoids with appropriate subdivisions under each major category. While many compounds are mentioned, some familiar ones are conspicuous by their absence, but this is understandable because the structures and absolute configurations for some of the terpenoids have not been studied during the past decade.

The book is not well suited for the beginner in these studies; consequently he will need to turn his attention to the prominent treatises on essential oils in order to avail himself of the extensive information which they contain and which has been gleaned from the older literature. Nevertheless, this book by de Mayo fulfills a critical need in keeping the modern terpene chemist abreast of the very rapid progress made during recent years.

By excluding the earlier literature, the author has become the victim of numerous erroneous interpretations concerning some generalities such as the economic significance of terpenoids, initial discoverers of compounds and the essential oils as a whole. For example, he states that terpenoids have limited industrial use as pure chemicals, with a few exceptions, e.g., santonin which is "widely" used as an anthelmintic. That santonin is "widely" used is highly questionable; however, even at best its application cannot compare with the million or more pounds of menthol furnished annually to the food and drug industry or with the millions of pounds of alpha-pinene which are annually converted to camphor and to terpin hydrate.

The discovery of nepetalactone is credited to McElvain. The reviewer is personally acquainted with the scientist who supplied the lactone to McElvain, and the results of her research on the compound are published. Lastly in illustration of oversights, reference can be made to the author's suggestion that counter-current distribution techniques have been applied but little to terpenoid investigation. Actually, they have been employed extensively by earlier investigators, however, in less formalized manner. Indeed, one industry, namely Naarden of Holland, produces terpeneless and sesquiterpeneless oils on a commercial scale by patented counter-current techniques.

These shortcomings, however, are of minor consequence; the important thing is that the modern chemistry of the terpenoids is here faithfully reviewed in great detail and reported with accuracy.

Paul J. Jannke
University of Connecticut

The Higher Terpenoids, P. de Mayo. Volume III in the series, **The Chemistry of Natural Products,** K. W. Bentley, Editor. Interscience Publishers, Inc., New York, New York, 1959. vii + 239 pp. $6.00.

This is a logical companion to Volume II in the series. The scientist who is interested in these fascinating natural products, collectively known as terpenoids, can hardly hope to find a greater return for money invested than is offered in the form of these two books. The terpene chemist will be greatly pleased to find contemporary literature condensed for him in highly professional form, employing the most modern

nomenclature and structural concepts. The "pure" organic chemist (nonterpenoid, that is) will be delighted to see classical organic reactions applied to compounds of complex structures, yielding reaction products along with an element of surprise.

Here again, as in Volume II, the author invokes the latest in physicochemical data, stereochemistry and reaction and mechanisms to arrive at the structures and absolute configurations of the higher terpenoids, whenever possible. The literature covered is for the most part the recent literature—or that which was most productive in structure elucidation. True, the earlier literature abounds with empirical information on the higher terpenoids, but at the level of this book the author need not concern himself with the requirements of the beginner. While each chapter is reasonably well documented by references, the reviewer would prefer to see many more of them. The book represents a high concentration of extensive literature; those who are the beneficiaries of it should not be deemed ungrateful for asking for more.

Virtually half of the 239 pages are covered by structural configurations, neatly and accurately reproduced. They lie opposite the printed page which carries their respective discussions. The format of the book is such that even though the subject is an involved one, it is a pleasure to study because it is presented clearly. The author has demonstrated a thorough knowledge of the subject, not on the basis of detail concerning any one compound, but through his capacity to correlate and to integrate the many new discoveries in a difficult area of research.

Those who are interested in the steroids will feel disappointment over the author's very limited offering. Recent advances in the chemistry of the unusual tetracyclic terpenoids like cycloartenol, euphol, and the like are interesting indeed; however, the more common and more familiar steroids have gone through comparable, if not more spectacular, studies during the past decade or more. Of the familiar sterols, only lanosterol is discussed at length in supporting the determination of its absolute configuration. Perhaps the author's reason for excluding such prominent compounds as cholesterol, sitosterol, stigmasterol, ergosterol, the bile acids, hormones, etc. is that these constitute a specialty of enormous breadth, already reviewed adequately in numerous texts and monographs. The author states, "The tetracyclic terpenoids are a group of substances which have been investigated only recently." Taking cholesterol as an exception to this statement, it must be admitted that the total synthesis of the alcohol was completed in 1951; however, the compound has been the subject of active chemical investigation for more than eighty years. Anyone who has read the splendid reports of Windaus, Willstaedter, Wintersteiner, Marker, and others can never forget that research among the sterols and steroids was proceeding at a vigorous pace years ago.

The final chapter of the book is devoted to the biogenetic relationships of the terpenoids. The material presented is very well handled but very limited in scope and point of view. Literature cited is, with very few exceptions, drawn from the last five years.

Notwithstanding several shortcomings, including those mentioned, the book provides an excellent condensed survey of the recent literature in this rapidly expanding area of complex natural products. If it is regarded from that point of view, the reader will not be disappointed.

Paul J. Jannke
University of Connecticut

Immunology and Development, Mac V. Edds, Editor. The University of Chicago Press, Chicago 37, Illinois, 1958. xi + 59 pp., 2 tbls. $2.50.

This book is a brief and concise report on the Conference on Immunology and Development, a part of the Developmental Biology Conference Series of 1956 held at the Roscoe B. Jackson Memorial Laboratory, Bar Harbor, Maine, in August, 1956.

The author has presented the proceedings of the conference in an essay form; this makes for easy reading without the loss of any of the important information presented. The various topics taken are in a logical sequence from specificity on the molecular level to tissue and organ levels. Studies are limited to those that have employed immunological methods of investigation. The experimental data on the subjects covered are discussed, and conclusions, as well as other possible interpretations that may be made, stated clearly. Problems left unsolved from data presented are made evident by posing them as unanswered questions, and this challenges the reader to continued thinking and work along the line of endeavor discussed.

Particularly interesting are the chapters on acquired tolerance and on the effect of antisera on tissues. The immunologic basis of organ specificity development is well discussed. While final answers or conclusions are not given, the advances and newer thinking gives one an updating on available information.

The use of immunological methods in problems of specificity at various levels of development open up new fields for immunologists to venture into. The limitations of the immunological approach are given in all instances, thus stressing the need for correlation of this method with other experimental procedures in seeking knowledge in the field of embryology.

The brevity and nature of this review make it impractical to discuss information included in the text.

While a selected bibliography is given to aid in further reading on the problems, the absence of annotation makes this a bigger task than it otherwise would be.

The volume is a valuable reference for workers interested in developmental biology, bringing up to date the available information on the problems of specificity of development and the potentialities of immunoembryology.

Romeo M. Zarco
Institute of Hygiene
University of the Philippines

The Profession of Pharmacy, Richard A. Deno, Thomas D. Rowe, and Donald C. Brodie, J. B. Lippincott Company, Philadelphia, Pennsylvania, 1959. xiii + 256 pp., 86 figs., 3 tbls. $6.50.

As stated in its preface, this book grew from several years' experience in offering the introductory courses to students in their first year of pharmacy study at the University of Michigan and at the University of California. It represents a survey in breadth of the profession of pharmacy.

Organized into fifteen chapters and an appendix, the book begins with a discussion of the dual nature of pharmacy as profession and business and its relation to the other health professions, and ends with a well-considered discussion of the future of pharmacy, based on developments to date, that is both realistic and optimistic. In between, an over-all view of pharmacy, its dependence on the basic sciences and other health professions, and the many contributions that pharmacy makes to these fields, is effectively interwoven with the story of penicillin; pharmaceutical education, the development of retail pharmacy, and its present status are presented in other chapters. A discussion of the nature and climate of science precedes the treatments of pharmaceutical research, the pharmaceutical industry, production and quality control, and the promotion and distribution of drugs. Hospital pharmacy, pharmacopeias and other standards, and legal regulations are treated in separate chapters.

The book is well and interestingly written and is easy to read. It is not a history, but it weaves historical background and developments into the text in an excellent manner. Organizations and their periodical literature are not treated in a separate chapter; they are introduced throughout the book where the type of activity with which they are concerned is discussed.

Features of the book include definitions or explanations of pharmaceutical terms when they are first used; provocative study questions for which the answers are not provided (and for which clear-cut answers are not always possible), plus annotated references at the end of each chapter; the citation of some of pharmacy's current professional and economic problems without attempting to gloss them over; and a helpful appendix containing a list of colleges of pharmacy, Latin terms and abbreviations, commonly used alphabetic designations, minimum standards for pharmacies in hospitals, and a chronology of major pharmaceutical landmarks.

The book should receive wide acceptance. It fills a long-standing need for a text in the course in pharmacy orientation that is given in most colleges. While it does not deal with calculations, techniques, and processes, it does emphasize nomenclature and should find wide usage as a reference for the course in beginning pharmacy. The practicing pharmacist will find the book of great value in the explanation and interpretation of the background of his profession to the public. It should be in the library of every pharmacist, whether student, educator, or practitioner, and should also find a place in high school and public libraries for the benefit of prospective students of pharmacy and the general reading public.

Lloyd M. Parks
Ohio State University

Hormones and Atherosclerosis: Proceedings of the Conference Held in Brighton, Utah, March 11-14, 1958, Gregory Pincus, Editor. Academic Press, Inc., New York 3, New York, 1959. xvi + 484 pp. $13.50.

As indicated in the title of this volume, it is the compilation of a series of papers presented at a conference organized by the Endocrinology Study Section of the National Institutes of Health.

A total of fifty-eight researchers currently carrying on investigations in the area of endocrinology and atherosclerosis contributed papers at this conference.

The volume is arranged in thirty-two chapters, each chapter containing the presentation by an author or authors of the various papers submitted at the symposium. At the end of each chapter, or in some instances after two or three chapters which are directly related, there is a transcript of the verbal discussion which took place after the paper had been presented.

According to the editor the program was designed to cover five major aspects of research currently being pursued in relation to hormones and atherosclerosis. As stated in the preface, "First of all, the problem of cholesterol metabolism is discussed in various aspects, including the nature of cholesterol biosynthesis, the hormonal influences thereon, and certain consideration of cholesterol catabolism. Second, the role of hormones in lipogenesis and lipid transport, particularly in relation to atheromatous lesions, is discussed. Third, available data on the influence of various hormones on experimental atherosclerosis are reviewed. Fourth, the much discussed problem of the interrelationship between blood lipids and the endocrine state in animals and man is pre-

sented in detail. Finally, we have a series of papers on clinical-biological interrelationships important to the consideration of endocrine influences on human atherosclerosis."

It is the feeling of the reviewer that the volume is quite comprehensive in its coverage of the current work and problems involved in this field. In the sections devoted to atherosclerosis in experimental animals there is good coverage of the work in dogs and chicks—but the experimental work with the rat by such workers as Hartroft, Malinow, and Fillios is conspicuous by its absence. The possible relationship of the emotions and the atherosclerotic process as presented by Roseman and Friendman was of special interest to the reviewer.

When one considers the vast amount of work and the number of publications which have appeared and are continuing to be reported in the literature pertaining to all the various aspects of atherosclerosis, a book of this nature is certainly a welcome addition to the library of any individual attempting to maintain some perspective of the direction that the research in this field is following. The book is a valuable reference source, especially for those whose primary interest is directed toward endocrinology. The information it contains and the questions which it raises should be available in the library of every school of pharmacy.

Howard E. Mossberg
Southwestern State College

Pharmacology, J. H. Gaddum. Fifth Edition. Oxford University Press, New York, New York, 1959. xvi + 587 pp., 93 figs., 31 tbls. $9.50.

This fifth edition of Gaddum's textbook, which follows closely the organization of previous editions, has been revised, the author says, to include all important drugs listed in the British Pharmacopoeia 1958 or in the Pharmacopeia of the United States (1955). Drugs are cited by their official names, and when these names differ in the two pharmacopeias both are given. Many unofficial drugs are discussed, and when Approved Names have been selected by the British Pharmacopoeia Commission these are used. Chemical names or formulae and proprietory names are usually included. Doses are cited for many of the drugs discussed. Official doses are those of the BP unless the drug is listed only in the USP in which case the USP dose is given. The metric system is used throughout the text.

Professor Gaddum has done admirably in lucidly presenting the principles of pharmacology within a book of usable proportions. Space has been conserved by presenting information on related compounds in tabular form. Most references in the text to figures or tables assist the reader with a page number. Adequate references to original sources and review papers appear as footnotes, and the introduction includes a brief guide to pharmacological literature. Gaddum's approach is that of a pharmacological investigator. Though the emphasis is on pharmacodynamics, discussions of therapeutic uses should satisfy the needs of pharmacy students or preclinical students of dentistry or medicine. Most chapters include a section on experimental methods, and many of the illustrations are reproduced from experimental records. Assay methods, when appropriate, are discussed, and the final chapter deals mainly with the principles of biological assay and drug evaluation. There is a chapter on toxic elements, and elsewhere in the text are discussions of drug and chemical toxicity and the treatment of poisoning. Through this excellent text the student can gain a well-balanced introduction to contemporary pharmacology.

The continuing introduction of new therapeutic agents makes it impossible to write and publish an up-to-the-minute text. Nevertheless, a number of drugs used in this country for well over a year are not mentioned. These omissions include certain of the newer antibiotics, sulfonamides, steroids, and diuretics as well as Penicillin O, Povidone Iodine, and Dioctyl Sodium Sulfosuccinate. The present interest in synthetic steroids is not indicated.

The decided British character of this text may prove disconcerting to those who would seek to use the book in this country, but to the reviewer this circumstance is only a minor detraction. A workable solution to this possible source of dissatisfaction could well be the use of the current edition of *New and Nonofficial Drugs* in conjunction with Gaddum's text. This arrangement will compensate for the omission of drugs now in use and in future years provide information on drugs yet to be introduced.

The reviewer, though somewhat sympathetic, has at times been frustrated in his efforts to get students to read certain of the widely used, more voluminous, American texts. Gaddum's very readable, more concise text (along with NND) can solve this problem, contribute to the student's comprehension and mastery of pharmacological principles, and save money for the student.

L. H. Sare
West Virginia University

Basic Principles of Parliamentary Law and Protocol, Marguerite Grumme. Marguerite Grumme, 3830 Humphrey Street, St. Louis, Missouri, 1955. 68 pp., 1 chart. $1.00 (paper).

The author, a Registered Parliamentarian, has produced a concise, pocket-sized (4¼" x 5¼") guide to parliamentary procedure which should find ready acceptance and use as an efficient means of solving the problems of procedure to which the officers and members of a group might become exposed.

Although the booklet may not be as complete in explanation as other prominent books on the subject, its value as a ready guide is not diminished nor is it less complete in its attention to every possible detail of handling a meeting or other situation properly. The pocket manual is based on Robert's Rules of Order Revised and offers a compact visual aid for premeeting study or for instant reference.

The first forty-four-page section deals with the rules of parliamentary law and outlines, briefly and to the point, the proper techniques for handling motions, debate, voting, agendas, reports, nominations, and elections. It explains the usual construction of bylaws, the handling of conventions, and provides complete coverage of the procedures and technicalities relevant to the various types of motions. The latter is further enhanced by a concise, 8½" x 9", folded chart for instant reference.

The second twenty-four-page section is entirely new and is devoted to basic protocol for clubs or other groups. It includes specific procedures and courtesies for guests from sending special invitations through guest welfare and seating to thank-you notes; for charter meetings, installations, and special features within a meeting; for inspirations, invocations, and closing thoughts. It details forty-three guides for presidents, and also outlines protocol for other officers and members. The booklet closes with twelve points which should improve any speaker's ability and effectiveness, particularly those persons who present papers before professional societies and conventions.

This booklet is recommended for anyone who must act correctly at the right time and place with on-the-spot maximum efficiency and minimum effort.

Robert V. Evanson
Purdue University

Psychopharmacology Frontiers, Proceedings of the Psychopharmacology Symposium of the Second International Congress of Psychiatry. Nathan S. Kline, Editor. Little, Brown and Company, Boston, Massachusetts, 1959. xviii + 533 pp., illus. $10.00.

Physically, as the report of the proceedings of a symposium, this book contains sixty-five papers by different authors from many parts of Europe and the United States. Consequently, many divergent views and opinions are presented. However, in the four parts into which it is divided, there appears to be agreement on several points. First of all, most of the contributors agree that the ultimate success of patient cure depends upon a judicious use of a combination of drug therapy and psychotherapy. Furthermore, notwithstanding the degree of success achieved with reserpine and chlorpromazine, medical science is only a little closer to discovery of the cause of certain psychotic conditions. While this may help to explain the title of *Psychopharmacology Frontiers,* it does not explain why some of the authors are dubious that this new science has a frontier.

In some respects, this book can be regarded as contributing a good deal to the area of psychiatry, insofar as most of the authors of the clinical papers can admit the inadequacies of their own experimental plans and the shortcomings of the techniques which they used in such clinical studies. Many of these writers expressed the feeling that the "double-blind" technique did not serve the function for which it was intended, viz: to eliminate the subjective influence of the patient and the researcher in the interpretation of results. Unfortunately, no substitute measure is suggested.

Considering the contents as a whole, this book cannot be recommended for anything other than for what it is intended, i.e., a rather special reference work. In that area however, it does an admirable job of presenting the problems encountered in clinical psychiatry, with recommendations as to the direction in which the solution to these problems lies. In addition, the section on the mode of action of psychotherapeutic agents should prove to be of value to the reader. This portion of the book describes all of the information available at the time of presentation in a sufficiently concise manner to allow anyone with some training in pharmacology to understand what is being said. The same cannot be said of other areas of the book which require some more thorough familiarity with the field of psychiatry.

The pharmacologist comes in for his share of discussion. Several of the writers lay the blame for the confusion which has arisen in the use of the descriptive nomenclature in the area of psychotropic drugs at the doorstep of pharmacology. At the same time, more than one of these papers show a misuse of basic pharmacological terminology, e.g., the classification of both reserpine and chlorpromazine as "ganglionic blocking agents."

In the final analysis, this book will be of value to a limited audience connected in some way with the fields of psychiatry and psychopharmacology. The editor, Dr. Nathan Kline, should be complimented for the successful completion of a very difficult task.

Vincent D. Lynch
St. John's University

The Cell, Biochemistry, Physiology, Morphology, Volume 1, Jean Brachet and Alfred E. Mirsky, Editors. Academic Press, Inc., New York, New York, 1959. xxi + 816 pp., 124 figs., 10 tbls. $22.00.

This book, the first volume of a three-volume series, is divided into two parts. The eight chapters of Part I include an introduction and descriptions of methods finding use by the zoo- and phytocytologist.

Herein optical methods, fixation and staining, autoradiography, quantitative microscopical, histochemical and cytochemical techniques, micrurgy, techniques and procedures of fractionation and isolation of subcellular components (as nuclei and their components, mitochondria, microsomes, chloroplasts, etc.), and tissue and cell culture are discussed. As stated by the editors, the aim is to present a critical evaluation of methodology employed in cytology rather than to give "cook book recipes" which can be easily found elsewhere.

Part II (seven chapters) deals with topics that should be called to the attention of pharmacologists and pharmacognosists who have a specific interest in general biology, genetics, embryology, and biochemistry. The main topics are: fertilization, sex determination, growth and differentiation, morphogenesis in plants, the acquisition of biological specificity, and the effects of radiations on cells.

Twenty leading biologists from the United States, Belgium, France, Sweden, and England have contributed to this large collaborative undertaking, which presents information culled over the past fifteen years. The format and physical structure of the book are excellent with tables of contents preceding each chapter, strict adherence to outline form of presentation, and exhaustive references listed by chapter. Very complete author and subject indices appear on the last seventy-six pages.

The apparent occasional lack of unity and continuity in the book attests to the difficulty of assembling the tremendously increasing knowledge and the new techniques in a field so complex into an organized pattern. It is to be hoped that obvious omissions of content will be adequately treated in Volumes 2 and 3 (tentatively to include information on cell constituents and specialized cells).

It is logical that a complete understanding of pharmacodynamics must necessarily be preceded by elucidation of further knowledge in cell biology at the molecular level. Therefore, because this book is a very comprehensive treatise on the most recent developments in methodology in cell biology and in the role of biochemistry in cytology, it is a must for every pharmacy library to implement graduate teaching in the biological sciences areas. The subject matter obviously is too complex for the majority of undergraduate students.

Fred T. Galysh
Baxter Laboratories, Inc.

Trifluoperazine, Clinical and Pharmacological Aspects, Introduction by Henry Brill. First Edition. Lea and Febiger, Publisher, Philadelphia, Pennsylvania, 1958. 219 pp., 3 figs., 35 tbls. $3.50.

The book consists of twenty-five papers prepared by leading investigators on the clinical and pharmacological aspects of trifluoperazine. The papers are arranged under five main headings into which the book is divided. They are: (1) Psychopharmacology, Pharmacology and Chemistry; (2) Functional Psychoses; (3) Brain Disorders; (4) Psychoneuroses and Personality Disorders; (5) Extrapyramidal Symptoms and Other Side Effects. An introduction by Brill serves primarily to present certain points of agreement and to discuss other general aspects of the papers. The second section (Functional Psychoses) comprises by far the largest part of the book. Fourteen clinical reports are included in this section. All the other sections consist of three reports each except the first section which consists of only two papers.

Although the articles under the first main heading are interesting and recommended for reading, they cannot be said to warrant the main heading assigned to them. In fact, one is hardly aware of any chemistry being discussed at all. Also, the pharmacology and psychopharmacology are presented in a rather abbreviated form. Data and experimental details and designs are for the most part lacking. A pharmacologist may well be disappointed in this aspect of the book.

The remaining sections may be considered clinical reports on the use of trifluoperazine in various mental disorders. The reports contain much information on the peculiarities of this evidently unique psychotropic drug. They also provide other information and observations on the side effects of the drug and how to avoid these side effects.

This book is recommended for physicians, pharmacists, and others who may desire a detailed knowledge of the proper use of the drug. It is also a valuable reference work.

Mario D. G. Aceto
University of Pittsburgh

Polarography in Medicine, Biochemistry and Pharmacy, M. Brezina and P. Zuman. Revised English Edition. Interscience Publishers, Inc., New York 1, New York, 1958. xviii + 862 pp., 319 figs., 24 tbls. $19.50.

As the translator's preface states, this book is the revised English translation of the second Czechoslovakian edition of *Polarography in Medicine, Biochemistry and Pharmacy.* The forward, written by the inventor of polarography, Professor J. Heyrovsky, reveals that the book originated from the collection of one of the author's systematic bibliographies. The literature appears to have been carefully reviewed through 1954, however, some articles have been reviewed as recently as 1956. There are more than 2,000 references listed, most of which come from the scientific journals of America, Europe, Japan, and India.

A survey of the contents of this book shows the main topics discussed are the polarographic and amperometric analyses of (1) Inorganic Compounds, (2) Organic

Compounds, (3) Proteins and (4) Enzymes; (5) a discussion of the Analytical Applications of Polarographic Maxima; and (6) a chapter of tables, listing buffer preparations and half-wave potential values of a large number of inorganic and organic compounds under varying conditions of pH and supporting electrolytes.

The first chapter gives a brief discussion on the nature of polarographic analysis. Theoretical considerations have been justifiably omitted since the book represents a compilation of the applications of polarography in the biological sciences. Nevertheless, the authors list suitable texts from which the reader may obtain detailed and technical information on the subject of polarography if desired.

Following this introduction, there is a general discussion of the determination of inorganic substances in biological materials. In this chapter the authors discuss the preliminary preparations required of biological samples prior to polarographic analysis. The ensuing chapters then discuss either briefly or in complete detail the different qualitative and quantitative procedures used for the determination of most of the inorganic elements and ions common to biological systems and susceptible to polarographic analysis. Many of these methods are given in sufficient detail so that reference to the original articles is not necessary. This is indeed fortunate, since many of these articles appear in foreign journals and would, therefore, require translations, a service not always readily available. Preceding the analytical procedures of each inorganic species is a short paragraph giving the important polarographic characteristic and the half-wave potential under specified conditions. When applicable, reference is made to polarographic and amperometric analyses of elements in pharmaceutical preparations, and in some cases these analytical procedures are discussed in complete detail.

The section on the determination of organic compounds is arranged to cover first the halogen derivatives and unsaturated hydrocarbons, the shape of the waves and the half-wave potentials of which do not change with pH, followed by the remaining functional groups whose waves and half-wave potentials are dependent upon pH. In the section on halogens is given the study of the breakdown of DDT, the determination of the purity of I-131 labeled thyroxine and many other applications illustrating the wide scope of polarography in the pharmaceutical areas. Again the material is presented in a manner so that reference to the original articles in many cases is not necessary.

The pharmacognosist and phytochemist will find a thorough and complete review of the polarographic method as applied to the qualitative and quantitative determination of alkaloids, glycosides, and other plant constituents.

The wide scope of polarography is again demonstrated in the chapter on indirect types of polarographic determinations. Two types are discussed: in the first, the polarographically inactive substance is converted by a chemical reaction into a compound giving a measurable wave; and in the second, a soluble complex is formed between the polarographically inactive substance and a suitable cation. The complex upon analysis then produces a measurable wave for the cation which is proportional to the concentration of the substance. These techniques are adequately described by many fine examples.

The chapter on proteins includes a very complete coverage of the Brdicka filtrate reaction used for the diagnosis of cancer. Many other extremely useful polarographic techniques are described which cannot be discussed because of the limited space.

The last chapter, which consists of a series of tables listing buffer preparations and half-wave potential values of a large number of compounds, should serve as a readily available source of invaluable polarographic data for the researcher in these areas.

Since no other book has been published dealing exclusively with the applications of polarography in medicine, biochemistry, and pharmacy, this book is unique, and a comparison to other books on polarography is not feasible. No other book in polarography deals so thoroughly in the polarographic techniques as applied to medicine, biochemistry, and pharmacy as does this book.

Research scientists working in these areas will find this book invaluable. Directors of medical and hospital laboratories may discover one or more polarographic techniques described in this book to be more suitable for routine analysis than existing methods.

As indicated by the title, this book was not translated to serve as a text on the principles of polarography, but rather to deal specifically with the topics suggested by the title. Therefore, I would recommend this book as an excellent addition to a pharmacy library.

Adelbert M. Knevel
Purdue University

Chemistry for Medical Technologists, Charles E. Seiverd. C. V. Mosby Co., St. Louis, Missouri, 1958. 465 pp., 68 figs. $10.75.

This book presents certain aspects of elementary chemistry and detailed directions for clinical analysis. These directions give a wide choice of methods and details for the more common instruments. Two surveys were employed as the bases for the selection of directions. There were (1) that conducted by Marion H. Cook of the Indiana Society of Medical Technologists and (2) that of the *Lab World* journal.

The first part of the book, Essentials of Elementary Chemistry, deals with basic

theory and techniques, preparation of solutions, and finally operation of colorimeters. The discussion is at an elementary level, but one might still find fault with the picture for the sodium chloride molecule (p. 18) as well as the statement, "salts are compounds whose molecules ionize when dissolved in water" (p. 28).

Part II, Urine Analysis, included routine examination, more specialized tests, quantitative determinations, kidney function tests, pregnancy tests, and finally tests for certain drugs and chemicals. On pages 125 and 136 there is apparently a typographical error resulting in the misspelling of fluorescence.

Part III, Blood Analysis, discusses and gives directions for the collection of blood, preparation of the blood, determination of blood sugar, nonprotein nitrogens, proteins, liver function tests, enzymes, electrolytes, and miscellaneous tests including the determination of blood levels of various drugs as well as certain vitamins.

Part IV, Spinal Fluid Analysis, describes the determination of glucose and chloride as well as the qualitative tryptophane test.

Part V deals with methods used in gastric and duodenal analysis.

There are, also, several appendices which include fecal analysis, milk analysis, electrophoresis and a test for gastric acidity, the preparation of reagents, and finally a set of Registry type questions and answers.

The book is an excellent compilation of methods for clinical chemistry, giving a wide choice of procedures. The norms for each quantitative determination are given as well as the diseases in which there are abnormalities. This volume should be in the library of those engaged in the practice of clinical chemistry.

Nathan Rubin
Philadelphia College of Pharmacy and Science

Colorimetric Determination of Traces of Metals, E. B. Sandell. Third Edition. Interscience Publishers, Inc., New York, 1959. xxii + 1032 pp., 110 figs., 134 tbls. $24.00.

The style of the third edition is similar to the previous edition, but it has been revised and expanded nearly 50 per cent to include new, worthwhile information. The first portion of the book (213 pages) deals with general aspects of colorimetric analysis of trace amounts of metals. Included in this section are discussions concerning reagents, standard solutions, and sampling. Of interest is the added section on the preparation of bio samples for trace metal determinations. A section on methods of separation and isolation includes chromatographic separation and electrolytic deposition. There is an extensive discussion of extraction by immiscible solvents. The section on colorimetry and spectrophotometry discusses the principles of the methods, sources of error, and conditions desired for satisfactory results. Detailed information is given about the general reagents for this type of analysis. There is a limited discussion of the inorganic reagents and an extensive review of the properties and uses of a number of organic colorimetric reagents.

The second portion of the book concerns itself with forty-eight elements and rare earths. For each of these it gives methods of separation, methods of determination, and in most cases application of this information to different types of materials. Thus for copper, it discusses sulfide separation, dithizone extraction, and other miscellaneous methods of separation while the determination is described in detail for three methods. Mention is made of many other methods with adequate references. It further describes the applications of these procedures for copper analysis for six different types of materials.

The evaluation of various methods is an important feature. Directions for analysis are complete so that further information should not need to be consulted as to methodology. However, extensive and up-to-date references to original publications are included.

This book should be of great value to those who are interested in the determination of trace amounts of metals and should be available in a pharmacy school library.

C. C. Clayton
Medical College of Virginia

Modern Pharmacognosy, E. Ramstad. Blakiston Division, McGraw-Hill Book Company, Inc., New York, New York, 1959. viii + 480 pp., 177 figs., 44 tbls. $10.50.

No recent event is more indicative of the change which has taken place in pharmacognosy than the publication of this book. The discontinuance by a major publisher of an authoritative and widely accepted text in favor of a new volume presenting an entirely different approach to the subject matter is certainly a step taken only after due consideration. In this instance it reflects the changes in emphasis in the teaching of the science which have taken place during the last decade.

The first two chapters of the book, comprising an introduction and an outline of the development of materia medica, are followed by thirteen chapters on natural drugs. These are classified according to the biogenetic relationship of their active constituents. Five chapters dealing with commerce, biosynthesis, drug activity, preservation, and storage and analysis complete the work. Two high points of the book are the superior illustrations and the extensive reference lists which accompany most chapters. Although discussion of the individual drugs is limited to only the most important natural products, this is quite adequate for a basic undergraduate course.

One of the inherent weaknesses of rigid adherence to any one classificational scheme for natural drugs is the necessity of separating groups of principles which are most logically considered together. Many drugs, including the carbohydrates, volatile oils, and alkaloids, are well suited to chemical or biochemical classification. Others, particularly glycosides and antibiotics, are less amendable to arrangement in this manner. Strict application of the biogenetic scheme in this volume results in the consideration of erythromycin as a fatty acid derivative in Chapter 5, tetracycline is placed in a group of its own in Chapter 6, and penicillin is associated with other proteids in Chapter 13. The arrangement also makes for some "strange bedfellows" and leaves the reader with the impression that he is subservient to the classification instead of the classification serving him.

Although the author quotes Tschirch's definition of pharmacognosy, " . . . to study scientifically the drugs of plant and animal origin from every viewpoint . . . ," descriptive biology, which has long been considered fundamental to pharmacognosy, is given only cursory treatment in this text. No doubt most considerations precluded a broader presentation of all phases of the science, and the descriptive features were sacrificed in the interests of more complete biochemical coverage. Still, this treatment is no more representative of pharmacognosy as a whole than previous textbooks devoted almost exclusively to taxonomic, morphologic, or pharmacologic considerations.

A course in pharmacognosy based on this volume would require supplementation with additional biological material in order to give the student a balanced view of the field. Nevertheless, the book covers very well those biochemical phases of pharmacognosy which are suitable for undergraduate presentation; it is competently written and dynamic in its approach. As such, it is an important new textbook and should receive careful consideration for adoption by teachers of pharmacognosy.

Varro E. Tyler Jr.
University of Washington

The Chemistry of Drugs, Norman Evers and Dennis Caldwell. Third Edition. Interscience Publishers, Inc., New York, New York, 1959. 415 pp. $12.25.

This is a revision of the book of the same title by Dr. Evers, which has not been available for many years. It is advertised on the dust jacket as "an essential work of reference for the pharmaceutical and medical professions."

Part I consists of a discussion of synthetic drugs, classified according to their pharmacological action; Part II deals with naturally occurring drugs. Almost half of Part II is devoted to the alkaloids, which are classified according to botanical source. The remainder of the drugs in the section on natural products are classified on a more or less chemical basis. The entire system of organization of the book leaves something to be desired; one finds discussions of steroid chemistry scattered in several different chapters, and whereas the syntheic sympathomimetic agents are discussed in Part I, epinephrine is covered in Part II, some 250 pages later.

References to the original literature are abundant throughout the book, and they are fairly up to date. However, the discussions of the drugs are extremely cursory. Little attempt is made to correlate chemical structure and biological activity; the book casts little light on the pharmacological effects of the substances being discussed. The action of Mephenesin is explained as follows: "Its muscle-relaxant properties were due to an effect on the nervous system."

An extended list of physical constants and properties is included for each drug discussed, and for various derivatives of the drugs as well. Such information would be less valuable to a pharmaceutical or medical practitioner or to a student than would a discussion of the reactions and the general stability and the modes of decomposition of the drugs. These topics are almost completely ignored.

For each drug, natural products as well as synthetic, methods of synthesis are presented. The reactions shown are developed on a cut-and-dried empirical basis. No use is made of electronic interpretations of organic chemistry or of mechanistic approaches. Many of the reaction routes as they are presented are difficult to understand.

Some attempt has been made to employ stereochemical concepts. The conformational forms of the tropane alkaloids are illustrated, as is a partial steric representation of aconitine. However, although a paragraph is devoted to a discussion of the applications of chair-boat conformations of cyclohexane to the absolute structure of the steroid nucleus, the authors do not show a conformational structural formula of any steroid.

The authors omit mention of the synthetic hypoglycemic agents; the index does not list such drugs as camphor, menthol, and p-amino-benzoic acid. Proofreading of the book has not been good. One notes the word "steroid" misspelled on the heading of page 309. The structure of Pethidine on page 32, drawn to show its similarity to morphine, is incorrect. The formula for barbaloin on page 363 omits one of the acetal oxygens of the glycoside. The basis of nomenclature used is the British Pharmacopoeia and British Empire trade names, which is a deterrent to use of the book in the United States.

It is the opinion of this reviewer that the book offers little new either as a refer-

ence work for pharmacists and those in allied fields, or as a textbook. It has no advantage over the standard American textbooks or reference works in pharmaceutical chemistry, and indeed is inferior to many American works in the same area.

Joseph G. Cannon
University of Wisconsin

Applied Medical Library Practice, Thomas E. Keys. Charles C. Thomas, Springfield, Illinois, 1958. xix + 495 pp. $10.75.

To some, the title of this volume will be confusing because they may expect it to be similar to the Medical Library Association's *Handbook of Medical Library Practice* (Doe, Janet and Marshall, Mary Louise, Editors. *Handbook of Medical Library Practice, with a Bibliography of the Reference Works and Histories in Medicine and the Allied Sciences.* Second Edition. American Library Association, Chicago, Illinois, 1956. 601 pp.) which, in fact, it supplements. Somewhat less than half of the volume's pages are devoted to current library techniques, and Mr. Keys' approach to these is in accordance with his description of the head librarian as an interpreter. So simple and clear are his descriptions that they will find most use by the physician, library committee, or novice medical librarian. His avoidance of complexity has even led Mr. Keys to the consistent use of the masculine pronoun for the chief librarian and the feminine for that of his assistants! Catherine Kennedy has contributed an excellent chapter on journals of abstracts and Ruth M. Tews, on the patients' library.

The pharmaceutical historian will find much of interest in the chapter on the development of private medical libraries and the four chapters on medical books and publishers through the centuries and medical history in general. Pharmacy librarians and scholars will find something of interest in the chapter on the place of the medical library in graduate medical education and research libraries in medicine. The chapter on representative medical libraries should also be useful although only two separate pharmaceutical libraries are listed, both industrial. The description of medical book publishers and the appendices listing such publishers, book dealers and antiquarian booksellers, most circulated journals, and medical works in facsimile will all be of considerable use for library book selection.

Mr. Keys' approach is scholarly, yet basic, and the book should serve as a delightful introduction to anyone interested in the library field.

Winifred Sewell
Squibb Institute for Medical Research

The New Chemotherapy in Mental Illness, Hirsch L. Gordon, Editor. Philosophical Library, Inc., New York 16, New York, 1958. xvii + 762 pp., 71 figs., 139 tbls. $12.00.

With the advent of the tranquilizer agents, great strides have been made in the field of mental health. This book represents a compilation of 118 previously reported investigations concerned with the usefulness of the various ataractic agents in the chemotherapeutic treatment of mental disease and management of alcoholic, senile, and emotionally disturbed patients. As such, the volume has some value for the clinician and student since the editor has performed a needed task by collecting a wide variety of articles revealing the effectiveness as well as the shortcomings of such tranquilizers as reserpine, chlorpromazine, meprobamate, promazine, proclorperazine, and a variety of other drugs used in the treatment of mental illnesses.

After an introduction by the editor and a list which describes the general history, chemical relationships, and actions of the recently discovered ataractic drugs, the author has divided the articles into four main sections: Part One: General Surveys; Part Two: Clinical Experience; (A) In Psychiatry Disease; Part Three: Clinical Experience: (B) In Related Conditions; and Part Four: Side Effects.

To a certain degree, one finds that the above groupings are spurious and repetitious since the greater majority of the individual reports discuss in part the history and clinical experiences as well as the side effects of the particular ataractic agents utilized in the respective studies. However, this procedure does attempt to combine and group the various investigations into somewhat more or less related categories.

Part One contains a series of fourteen reports of a review type which cite the general usefulness and applications of the various ataractic drugs in medical practice. Part Two contains sixty-four scientific contributions reporting on the clinical results observed during the treatment of ambulatory and hospitalized patients suffering from psychotic, neuropsychotic, and anxiety states. Part Three contains twenty-two articles revealing the effects of chemotherapeutic treatment upon patients suffering from disorders associated with alcoholism, drug addiction, senile anxiety states, depressions of Parkinson's disease, and epilepsy. Part Four consists of eighteen publications, reporting on the side effects produced by the various ataractic agents ranging from minor symptoms of limited clinical significance to reactions of major proportions such as blood dyscrasias, jaundice, and hepatic complications.

The book has serious shortcomings for the investigator in that the editor has deleted

the original bibliographies ordinarily contained in scientific publications. In addition, by providing an inadequate bibliography, the author renders it a difficult and laborious task to locate the original cited reprints. A more serious shortcoming, however, is presented by the failure of the editor to include investigations dealing with the insulin, metrazol, histamine, and hormone chemotherapeutic measures which have been utilized in the treatment of mental disorders.

In the opinion of the reviewer, this text is useful in that it represents a comprehensive compilation of dozens of scientific journals and investigations dealing with the more recent chemotherapeutic treatments and tranquilizer agents. As such, it can be recommended as an addition to pharmacy libraries or to the libraries of clinicians, investigators, and students intimately concerned with mental health therapies and procedures.

A. S. Weltman
Brooklyn College of Pharmacy
Long Island University

One of the tests of an educated person today is the extent of his or her ability to distinguish between inspired propaganda and the dissemination of factual information.

Robert P. Fischelis, Am. J. Pharm. Ed., 9, 537 (1945)

NEW BOOKS

Industrial Fatty Acids and Their Applications. E. Scott Pattison. Reinhold Publishing Corp., New York 22, New York, 1959. iii + 230 pp., figs., tbls. $7.00.

Polymers and Resins, Their Chemistry and Chemical Engineering, Brage Golding. D. Van Nostrand Co., Inc., Princeton, New Jersey, 1959. viii + 744 pp., figs. $15.00.

An Introduction to Chemical Engineering, Charles E. Littlejohn and George F. Meenaghan, Reinhold Publishing Corp., New York 22, New York, 1959. xiii + 271 pp., figs., tbls. $6.50.

Natural Selection and Heredity, P. M. Sheppard. The Philosophical Library, New York 16, New York, 1959. 212 pp., 8 figs. $6.00.

Pharmaceutical Selling, "Detailing" and Sales Training, Arthur F. Peterson. Second Edition, Heathcote-Woodbridge, Inc., Scarsdale, New York, 1959. xviii + 384 pp., figs., 4 tbls., 35 illus. $7.95.

Handbook of Toxicology, Volume IV, Tranquilizers, Maxwell Gordon and R. F. J. McCandless. W. B. Saunders Co., Philadelphia, Pennsylvania, 1959. viii + 120 pp. $4.00 (paper).

The Merchants of Life, Tom Mahoney. Harper and Brothers., New York 16, New York, 1959. x + 278 pp. $3.75.

Progress in Biochemistry Since 1949, Felix Haurowitz. Interscience Publishers, Inc., New York 1, New York, 1959. xii + 357 + 2 pp., figs. $8.50.

Mirage of Health, Utopias, Progress, and Biological Change, Rene Dubos. Harper and Brothers, New York 16, New York, 1959. xv + 236 pp. $4.00.

Encyclopedia of Chemical Reactions, Volume VIII, C. A. Jacobson and Clifford A. Hampel. Reinhold Publishing Corp., New York 22, New York, 1959. 533 pp. $14.00.

Handbook of Toxicology, Volume III Insecticides, William O. Negherbon. W. B. Saunders Company, Philadelphia 5, Pennsylvania, 1959. xxv + 854 pp. $14.00.

Methods of Biochemical Analysis, Volume 7, David Glick. Interscience Publishers, Inc., New York 1, New York, 1959. ix + 353 pp., figs., tbls. $9.50.

The American College, P. F. Valentine. The Philosophical Library, New York 16, New York, 1949. xvi + 575 pp. $10.00.

Plant Propagation: Principles and Practices, Hudson T. Hartmann and Dale E. Kester. Prentice Hall, Inc., New York 11, New York, 1959. ix + 559 pp., figs. $8.75.

Emergency Treatment and Management, Thos. Flint, Jr. Second Edition. W. B. Saunders Co., Philadelphia 5, Pennsylvania, 1958. xvii + 539 pp., tbls. $8.00.

The Challenge of Science Education, Joseph S. Roucek. Philosophical Library, New York 16, New York, 1959. vii + 491 pp., 5 tbls. $10.00.

A Synopsis of Pharmacology, With Special Application to Dentistry, V. C. Sutherland. W. B. Saunders Company, Philadelphia 5, Pennsylvania, 1959. viii + 267 pp., 8 tbls. $4.00.

Fundamentals of Physical Chemistry, H. D. Crockford, Samuel B. Knight. John Wiley and Sons, New York 16, New York, 1959. xv + 463 pp., figs., tbls. $6.95.

Accreditation in Higher Education, U.S. Department of Health, Education, and Welfare, Office of Education, United States Government Printing Office, Washington, D.C. viii + 247 pp. $2.50 (cloth), $1.50 (paper).

How to Outsell the Born Salesman, William W. Frank and Charles L. Lapp. The Macmillan Company, New York 11, New York, 1959. xi + 226 pp. $4.50.

Diagnostic Biochemistry, Halvor N. Christensen. Oxford University Press, Inc., New York, 1959. ix + 291 pp., figs. $6.50.

Anatomy and Physiology, Volume 1, Edwin B. Steen and Ashley Montagu. Barnes and Noble, New York 3, New York, 1959. xv + 332 pp., figs. $2.50.

Treatment of Diabetes Mellitus, Elliott P. Joslin, Howard F. Root, Priscilla White, and Alexander Marble. Tenth Edition, Revised. Lea and Febiger, Philadelphia 6, Pennsylvania, 1959. 798 pp., 41 figs., 153 tbls. $16.50.

Preventive Medicine, Herman E. Hilleboe, and Granville W. Larimore. W. B. Saunders Company, Philadelphia 5, Pennsylvania, 1959. xxi + 731 pp., 59 figs., 33 tbls. $12.00.

Curare and Curare-Like Agents, D. Bovet, F. Bovet-Nitti and G. B. Marini-Bettolo. Elsevier Publishing Company, Princeton, New Jersey, 1959. xi + 478 pp., figs., tbls. $15.75.

Medicinal Chemistry, Volume IV, F. F. Blicke, L. A. Woods, and Harriet Geer. John Wiley and Sons, Inc., New York 16, New York, 1959. ix + 334 pp., 230 tbls. $12.00.

Investing for a Successful Future, Thomas E. Babson and David L. Babson. The Macmillan Company, New York 11, New York, 1959. viii + 312 pp., 60 tbls. $4.95.

Textbook of Toxicology, Kenneth P. DuBois and E. M. K. Geiling. Oxford University Press, New York 16, New York, 1959. x + 302 pp., 2 figs., 21 tbls. $6.50.

Quantitative Methods in Human Pharmacology and Therapeutics, Volume 3, D. R. Laurence. Pergamon Press, New York 22, New York, 1959. xvii + 253 pp., figs., tbls. $7.50.

MISCELLANEOUS

Unpublished Abstracts of Articles on Pharmaceutical Subjects, Series 6, Henry M. Burlage. Henry M. Burlage, College of Pharmacy, The University of Texas, Austin 12, Texas, 1959. 58 + 24 pp. Series 1, 2, 3 and 4, $1.00; Series 5, $1.50; Series 6, $2.00 (all paper).

Accreditation Manual (formerly Accreditation Policy and Procedure). Sixth Edition. The American Council on Pharmaceutical Education, Chicago 2, Illinois. Effective from July 1, 1960. 30 pp. Free (paper).

Teaching References for Courses in Pharmacy Administration, McKesson & Robbins, New York 17, New York, 1959. 29 pp. Free (paper).

Handbook, Chemical Control of Range Weeds. Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C., 1959. 96 pp. $1.00 (paper) (Cat. No. A 1.11:W 41).

Glaucoma References. Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C., 1959. 16 pp. $0.10 (paper) (Cat. No. FS 2.24: G 46).

Tuberculosis. Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C., 1959. 13 pp. $0.10 (paper) (Cat. No. FS 2.50: 33/3).

Syphilis and Gonorrhea. Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C., 1959. 6 pp. $0.05 (paper) (Cat. No. FS 2.50: 84/2).

Viral Hepatitis, Clinical and Public Health Aspects. Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C., 1959. 56 pp. $0.20 (paper) (Cat. No. FS 2.60/2:H 41).

Higher Education Planning and Management Data, 1958-59. Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C., 1959. 126 pp. $1.00 (paper) (Cat. No. FS 5.4:549).

Antibiotic Therapy. Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C., 1958. 16 pp. $0.10 (paper) (Cat. No. D 101.25: MED 9).

Health Statistics from the U.S. National Health Survey, Acute Conditions Incidence and Associated Disability, United States, July 1957-June 1958. Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C., 1958. 47 pp. $0.35 (paper) (Cat. No. FS 2.85:B-6).

Scientific Translations: A Guide to Sources and Services. Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C., 1959. 19 pp. $0.15 (paper) (Cat. No. FS 2.202:T 68/958).

Comments on Narcotic Drugs. Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C., 1959. 186 pp. $0.60 (paper) (Cat. No. T 56.2:N 16/3).

Insecticide Recommendations of the Entomology Research Division for the Control of Insects Attacking Crops and Livestock, 1959 Season. Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C., 1959. 129 pp. $0.65 (paper) (Cat. No. A 176: 120/959).

Fatty Acids in Food Fats. Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C., 1959. 4 pp. $0.05 (paper) (Cat. No. A L.87:7).

Diet, Hormones, and Atherosclerosis, A Review of Research Grants Supported by the National Heart Institute, Fiscal Years 1949-1958. Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C., 1959. 97 pp. $0.50 (paper) (Cat. No. FS 2.22: D 56).

Television in Education. Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C., 1958 (reprinted). 124 pp. $0.65 (paper) (Cat. No. FS 5.3:957/21).

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To meet the demonstrated need for qualified teachers and researchers in the field of pharmacy, the American Foundation for Pharmaceutical Education announces a limited number of fellowships for students seeking graduate degrees in pharmaceutical subjects.

These fellowships are open to students (men and women) qualified for registration in approved graduate schools or colleges for one or more of the following major fields:

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PHARMACEUTICAL CHEMISTRY

PHARMACOLOGY

PHARMACOGNOSY

PHARMACY ADMINISTRATION

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New applications and requests for renewal of Fellowships must be received between February 15 and March 15.

W. Paul Briggs, Secretary

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